

From the Publishers of Model Airplane News



Radio Control

CAR ACTION

THE WORLD'S PREMIER R/C CAR MAGAZINE



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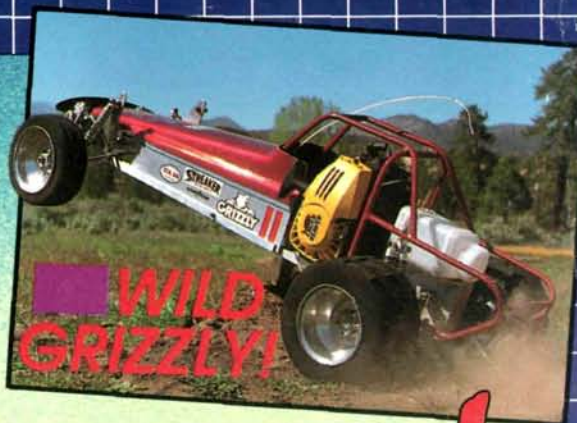
Summer 1986

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**R/C Pro
Stock**



Awesome!

**Hot
Modeling
Tips**



C CONTENTS

Volume 1, Number 3
Summer 1986

ON THE COVER: That awesome four-wheel-drive monster truck is the latest creation from Hobby Shack. It's called Big Grizzly and we just couldn't wait to get it on the cover. Look for a full-blown review next issue. Throwing the rooster tail is the Icarus from Great Planes, the flamed vehicle is Cory Savage's R/C Pro Stock, and the wheelie buggy is the new Grizzly from Pacesetter. Big Grizzly, Icarus, and Grizzly photographed by Louis V. DeFrancesco, Jr. Pro Car photographed by Cory Savage.

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EDITORIAL

by LOUIS V. deFRANCESCO JR.

GREAT NEWS! *Radio Control Car Action* has been so successful that we will soon be bringing you even more great R/C car coverage. As of December 1986, we will be publishing six issues a year on an every-other-month basis. We've discovered that there's a great demand for exciting, action-packed information on the world of R/C cars, and we're here to meet that need.

Not a week goes by now that I don't run into a gaggle of R/C car modeling enthusiasts running in a school yard, park, back lot, or yard; and this is not happenstance. A friend of mine even saw a bunch of kids running their cars along the sidewalk on 7th Avenue in New York City!

R/C car modeling is nothing short of a national craze—and this is only the beginning! The technology and production of R/C cars and accessories has so accelerated that we can barely keep up. But you, the modeling enthusiast, are the direct benefactor. This means quite a diversity of higher quality products at lower prices.

And speaking of new products, wait until you see what we have for you in this issue. We've got reviews on all the hottest R/C cars, including the nasty Marui Big Bear, the top-selling MRC-Tamiya Hornet, the awesome Pacesetter 1/4-scale Grizzly powered by a chainsaw engine, the revolutionary 1/10-scale Assault gas off-roader from Great Planes which may very well be the start of a new R/C trend, and much more. If your latest R/C car won't run, our troubleshooting article might just have the answer, and you can learn all about battery packs in Mike Lee's article. Also, check out Cory Savage's (our resident California R/C Guru) new outrageous 1/4-scale R/C Pro Stocker—it will blow your mind!

With this issue we introduce a new column by the talented Jim Newman called "Pit Tips." This column is unique because it relies on your input. If you have an informative modeling tip you would like to share with your fellow R/Cers, just mail it in with a rough sketch and we'll take it from there. If we publish it, you'll get a one-year subscription on us! By the way, Jim Newman has been doing a similar column in our sister magazine, *Model Airplane News*, for 15 years and he is the most talented illustrator in the hobby industry.

Anyway, keep those letters coming in, watch those frequencies, and go wild with your latest R/C creation. ■



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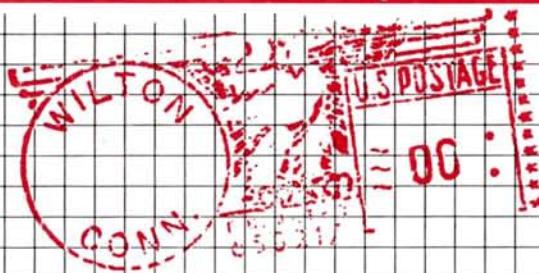
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Letters



We're on the Right Track!

I am a 15-year-old R/C car enthusiast and I'd just like to say that I think you're doing a great job with the magazine. I was wondering if you would do a review of the electronic speed controllers on the market today.

STEVE SNODGRASS
Kentfield, California

Excellent photography! Very good articles on cars, equipment, etc. Please—stay away from event coverages other than majors—you're doing great!

RON BURGESS
Los Angeles, California

I just bought your Spring '86 issue and read your premier issue about 10 times. I'm enjoying them both. I am new to the R/C car craze and have learned a great deal about my car, the "sport" of racing, and the availability of parts from your magazine. Keep up the great job!

DAVID WILSON
Grand Junction, Colorado

I really like your magazine! It has everything. I especially liked the articles on the MRC Bruiser and the Team Associated RC10.

NATHAN SOUKUP
Upland, California

I just recently saw one of your issues and I'm really impressed by the photos and the way it's set up.

DAVID PILLADO
Redwood City, California

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Letters," Radio Control Car Action, 632 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and length.

Drag Racing

Our compliments on putting together a fine R/C car magazine. This magazine should be a great help with the operation of our raceway, furnishing the latest information to our customers.

We have developed a fully operational lighting and timing system for a drag strip, complete with the Christmas tree, ET clock, speed curve, and photo electric cell indicators. We are contemplating advertising specially modified cars for drag racing. We would appreciate your comments and thoughts.

DON HALL
Don's Raceway
Vernal, Utah

There seems to be a growing interest in R/C drag racing, Don, and there is even an R/C drag racing association being formed called J.E. Rat Racing (90 W. Montgomery, Suite 255, Rockville, MD 20850). LVD

He Likes Hornet

I really like the MRC-Tamiya Hornet. I was wondering if you could write an article about the Hornet in your next issue of *Radio Control Car Action*.

BRIAN KOT
Flushing, Michigan

You're in luck, Brian. See Rich Uravitch's "Track Report" in this issue. LVD

Would Like to See the Frog

I have the MRC-Tamiya Frog R/C car and was wondering if you could put an article in your next issue on it.

JONATHAN HANSON
Flushing, Michigan

Jon, you're in luck—turn to "Suspension Systems" on page 20 where Mike Lee tells all about the Frog. LVD

RC10 Questions

I enjoyed reading your fine article on the ultimate off-road R/C vehicle, Associated's RC10 in the Winter 1986 issue of *Radio Control Car Action*. Where can I get that neat front bumper guard pictured on page 25?

CRAIG STOIE
Farmington Hills, Michigan

Craig, that front bumper and other accessories are available from Custom Racing Products, P.O. Box 1485, Dept. 6F, Temple City, CA 91780.

LVD

I recently purchased an issue of your magazine. I think it's great! Finally a magazine that deals with cars and only cars. I was really writing about the article on Associated's RC10 on pages 24-26 of the Winter issue. Did you make the aluminum spoiler or did you buy it from a manufacturer?

TODD DONALDSON
Columbus, Ohio

Todd, others have inquired about this wing and it's available from Thorp Mfg. 380 S.E. End, Unit H, Pomona, CA 91766.

LVD

About Discharging...

I think your magazine is the greatest for covering R/C cars. I have a question about batteries. In the Spring '86 issue under "Hopping Up Electric Cars," it explains how to discharge to a voltage of around 6 volts for a 7.2-volt pack. Is this after it's taken off the discharge?

DARREL MAY
Meridian, Mississippi

Darrel, a foolproof way to discharge is just to make sure you have discharged the pack for a least 15 minutes. This is usually sufficient. LVD

R/C Electronics

by CHARLIE KENNEY

Circus Hobbies **JR Winner Series Radio**



photos by SUE KENNEY

New Winner radio from Circus Hobbies incorporates many desirable features.

IN THIS ISSUE, I have the opportunity to review another new car radio, the Circus Hobbies* JR Winner Series 2-channel pistol-grip radio, manufactured by the Japan Remote Control Company. The radio provided for me operated on channel 4—27.145 MHz, using a yellow frequency flag.

The Circus Winner 2 arrived in a black and white checkered box replicating the winner's flag. Inside, packed neatly in a styrofoam container, I found the transmitter, receiver, two servos, receiver battery box with integral switch, frequency flag, and servo mounting fittings. No batteries are provided, but the system can use nickel-cadmium batteries without any major modifications. The transmitter has a charging jack so that nickel-cadmium batteries can be substituted directly. Please note that the center pin of the charging connector has a negative polarity rather than a positive one. The receiver battery case will also accept nickel-cadmium cells but you'll have to rig a way to charge them as no charging jack is provided on the switch harness. And, of course, if you don't have a charger, you'll have to get one. The JR

has all the accessories necessary and I'll discuss them later.

Upon opening the styrofoam case, you see a real classy-looking pistol-grip transmitter. Molded from black plastic, it's comfortable to hold, with all controls on the front panel. Let me summarize the features of the system:

Transmitter—JRTW275

- Size: 8.5x6.75x3.75 inches
- Weight: 1.5 pounds
- Removable collapsible antenna
- Plug-in crystal
- AM modulation
- Frequency band: 27 or 75 MHz
- Two channels
- Servo reversing
- Steering and throttle end-point adjustment
- Steering and throttle trim
- Antenna clip mount

Receiver—NER722X

- Size: 1.78x1.27x0.84 inches
- Weight: 1.06 ounces
- Operating voltage: 6V DC to 4.4V DC (4 AA alkaline or nickel-cadmium cells only)
- Receiving range: 600 feet (ground)
- Operating time: 1-3 hours depending on system load
- Current drain: approximately 30 mA
- Sensitivity: 2.0 uV
- Frequency band: 27 or 75 MHz
- Antenna length: 19.7 inches (50 cm)
- 2-channel positive pulse output
- 1.5 mx neutral timing

Servo NES505

- Size: 2.125x0.875x1.875 inches
- Weight: 2 ounces
- Rugged precision high-speed output
- Indirectly coupled feedback pot for superior vibration resistance



Front panel controls are very easy to use. See text.

- Tight deadband amplifier for precise control timing
- Rugged heavy-duty gears
- Splined output shaft eliminates need for centering feedback pot
- JR 3-point alloy plated connectors for reliable electrical connections
- Torque: 41 oz-in.
- Transit time: 0.27 sec./60°

Accessories

- Integral switch harness and battery holder
- Servo grommets
- Transmitter control adjustment tool
- Frequency flag

The heart of the Circus Winner 2 is the transmitter, so let's start there. At the top left is an 8-element, 32.75-inch antenna which collapses to 7.25 inches. It can be removed and clipped into a storage slot on the rear top of the transmitter. Also, on the transmitter rear is a charging jack if you elect to use nickel-cadmium batteries.

On the upper left front panel is a rectangular cutout which contains the steering and throttle servo end-point adjustments and below them are the servo-reverse switches. The EPA controls are used to set the servo throws. For example, the steering EPA can be used

to independently set the maximum left and right steering throws. The same is true for the throttle; each end-point of throttle throw can be set independently. Each EPA control has a calibrated dial.

Below the EPA controls are two slide action switches for servo reversal. The steering switch is to the left, the throttle right. The down position is normal and up is reverse. In the center of the transmitter top is the steering wheel. You turn the wheel right to steer right and vice versa. It's spring-loaded to neutral.

Below and just to the left is the steering rate adjustment thumb wheel. This is controlled by the thumb on your trigger hand. It can be used to reduce full servo throw (100%) down to 30% simply by actuating the wheel with your thumb. Remember the excursion of the steering



NER-722X receiver is very compact.

servo is set up by the EPAs, so the 100%-30% control of the thumb wheel is between those end points.

Under the steering wheel and slightly to the right of its center is a screw hole where the steering wheel tension can be adjusted to your particular feel. Clockwise movement of the screw increases tension, counterclockwise decreases it.

Moving to the right, there are two calibrated trim controls; the upper is steering trim. This is used to make trim corrections, steering right or left, to obtain neutral when the steering wheel is in neutral. The second trim control is for throttle. It's used to adjust the braking when the throttle trigger is released back to neutral. The braking will increase when you turn the knob clockwise and will decrease when you turn it counterclockwise.

To the right of the trim controls is the power meter. It gives a relative power output indication with the antenna in a fully extended position. Note the needle's position when new batteries are installed. The meter will drop into the red zone when the batteries need to be replaced. Below the indicator is the On/Off power



Winner as it arrives, with servos, receiver, and pack.

switch. Up is On and down is Off. To the left of the On/Off switch is the removable 27 MHz crystal.

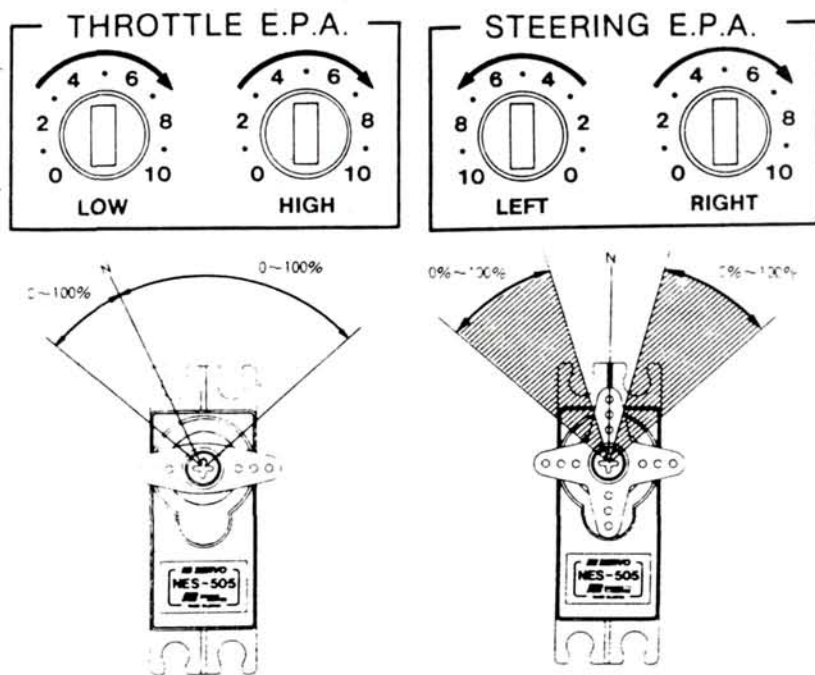
Finally, there is the throttle trigger. This is the main forward and reverse or brake control. By pulling back on the trigger, the model will go forward and pushing forward on the trigger will cause the model to either reverse or brake, depending on the speed control used. These controls are shown in Figure 1.

Circus Hobbies has included an excellent car steering set-up procedure in their instructions which I believe is worth repeating:

"1. Connect all steering linkages, making sure there is no binding or excessive drag, following the car manufacturer's instructions. Next, connect linkages to steering servo arm or wheel.

"2. Turn on transmitter and receiver. Turn steering rate adjustment thumb wheel all the way to the right (maximum). See Figure 2.

(Continued on page 103)



Throttle and steering trim controls are quite accessible and accurate.

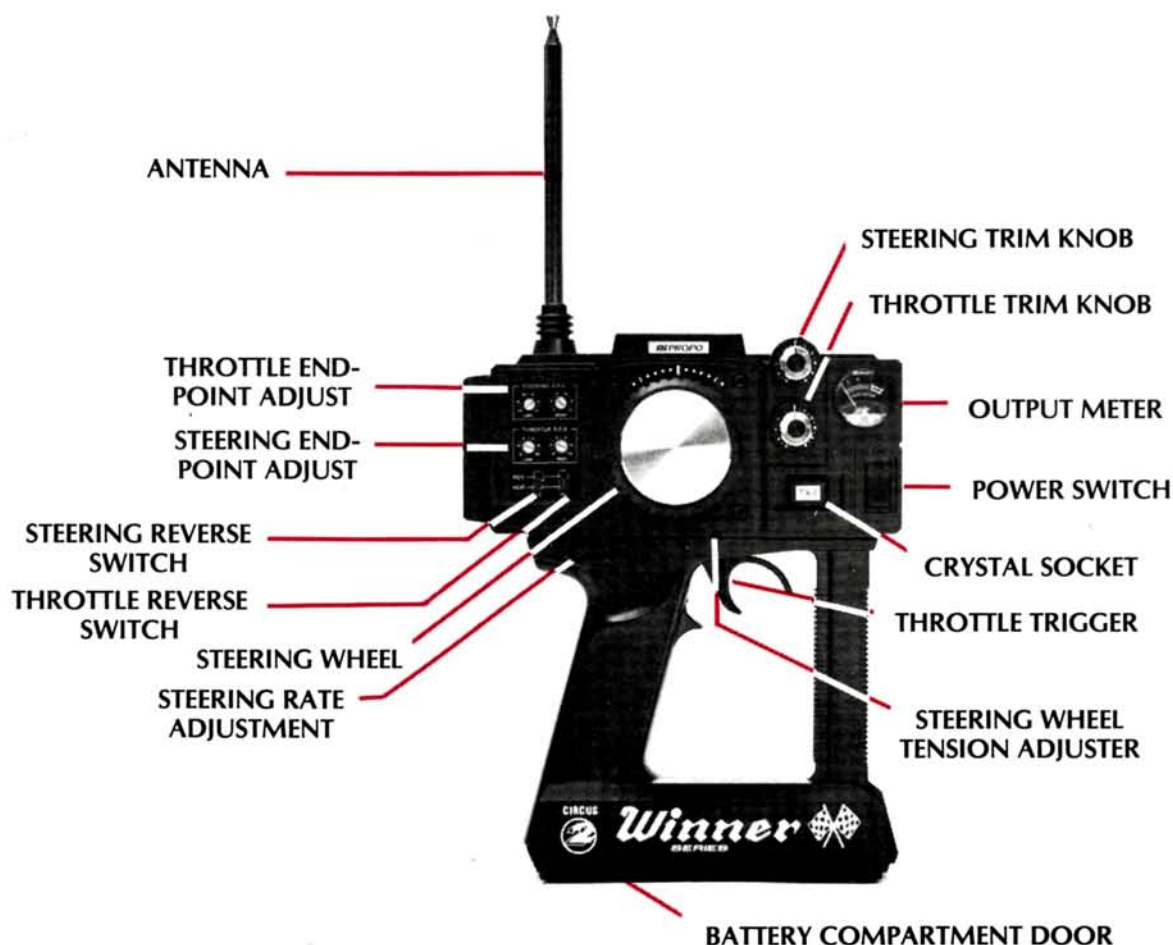


FIGURE 1

The Starting Line

by Fred Fischer

This question/answer format is designed for beginners and will attempt to answer questions, correct misconceptions, and generally ease entry into the rapidly growing hobby/sport of R/C cars. We welcome your questions, as answers to representative questions will help other beginners. Direct your questions to Fred Fischer, c/o R/C Car Action, 632 Danbury Rd., Wilton, CT 06897.

Let's take a look at keeping your car well lubed. This is one area I know has been ignored or inadequately handled in the past.

By the way, I appreciate the letters I've received to date. Your interest certainly proves that R/C cars are here to stay and will keep growing too!

Q. When is the best time to grease and oil my car?

A. Grease and oil your car from the very start; when you're building it. If sliding or meshing parts, such as gears, don't fit so well, a light application of grease might make them go together a lot smoother. Rotating parts, such as bearings or bushings, may need oil or grease, depending on their composition.

Q. What kind of oil or grease should I use?

A. For oil, a light penetrating machine oil, such as sewing machine oil or one of the multi-purpose oils, works fine. Good greases range from petroleum jelly up to molybdenum grease. Lithium grease may work in some circumstances, but there have been reports that this grease causes unusual wear. Graphite "lock grease" is a definite no-no!

Q. Where should I apply grease?

A. Grease should go on gear teeth, sliding surfaces such as suspension joints, and contact points of drive shaft pieces. Use only a light coating; loading up a gear box with grease will only cause excessive wear and will undoubtedly slow down your car.

(Continued on page 14)



What are logical oil points?



First, any bronze bushing should get some oil. These bushings are sometimes called oil-less bearings, which is confusing since they're designed to hold a little oil in the metal itself. If you put too much oil on them, they can wear down more quickly by attracting too much abrasive dirt; with no oil they wear out and won't lubricate and cool the bushing. Ball bearings use oil to keep them rotating smoothly. Axles and gear shafts should get both a little oil and a little grease.



How often should I give my car a "lube job"?



After building a car, the first check for proper lubrication should be right after breaking-in the motor and gear box. Pay special attention to gears and drive shafts; the fast spin of these parts may have thrown off most of the oil and grease. Don't expect the manufacturer to have greased or oiled any pre-built gear box. Do the initial lubrication when you build the car and then before you test-drive it.



What can I do to keep dirt from getting on the gears or drive shafts?



Some of the prevention rests on the kit itself. Most manufacturers use sealed gear boxes for protection from dirt. Don't defeat the purpose by trying to make the box easier to open. As for drive shafts, some kits use rubber boots to cover all joints but where this isn't possible, just use a careful application of grease and oil, and clean off the excess. Clean out any dirt accumulation in gear teeth and bronze bushings immediately.



What's the best way to apply grease or oil?

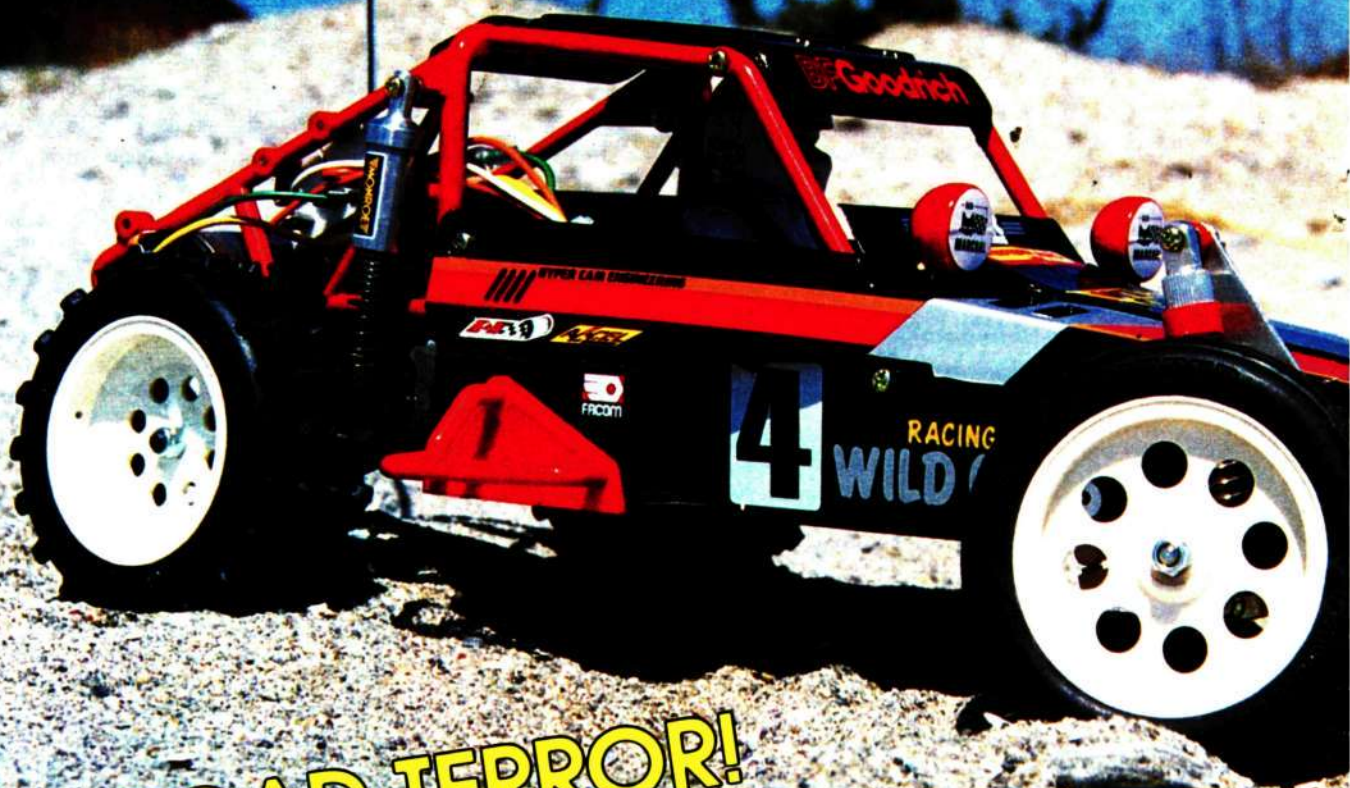


For grease, a small, wide modeling paint brush is best, while a needle-point oiler is highly recommended for careful oil application. ■

Track Report

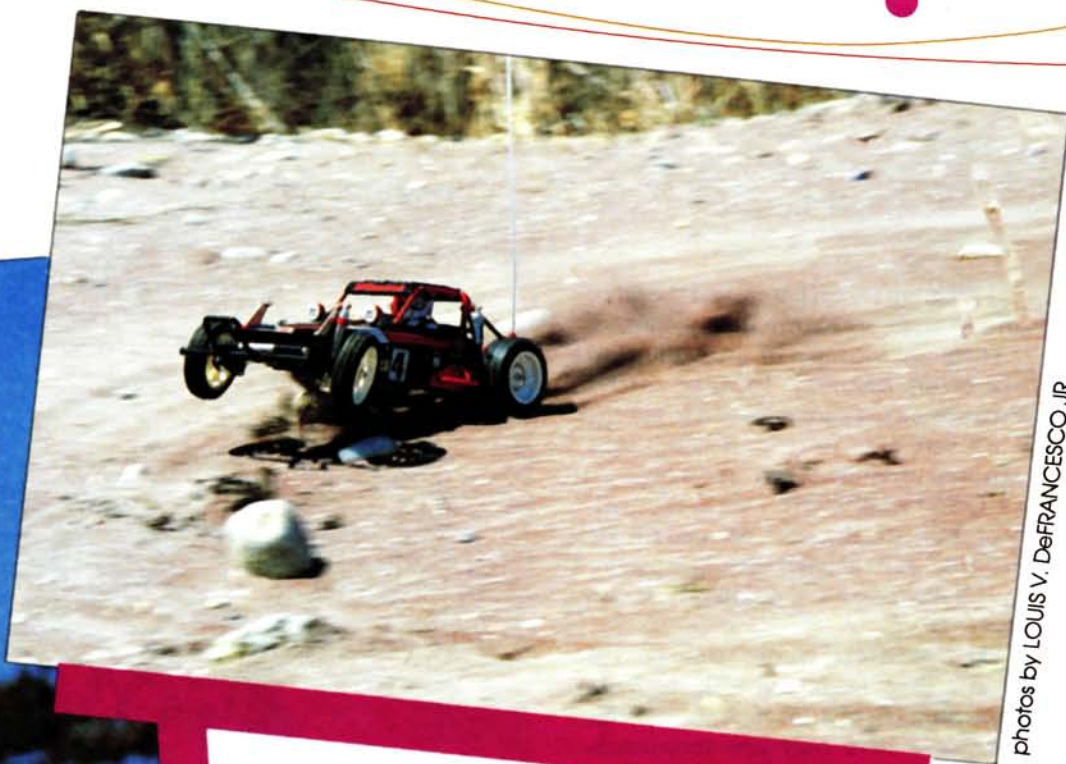
from MRC-Tamiya

The Wild O

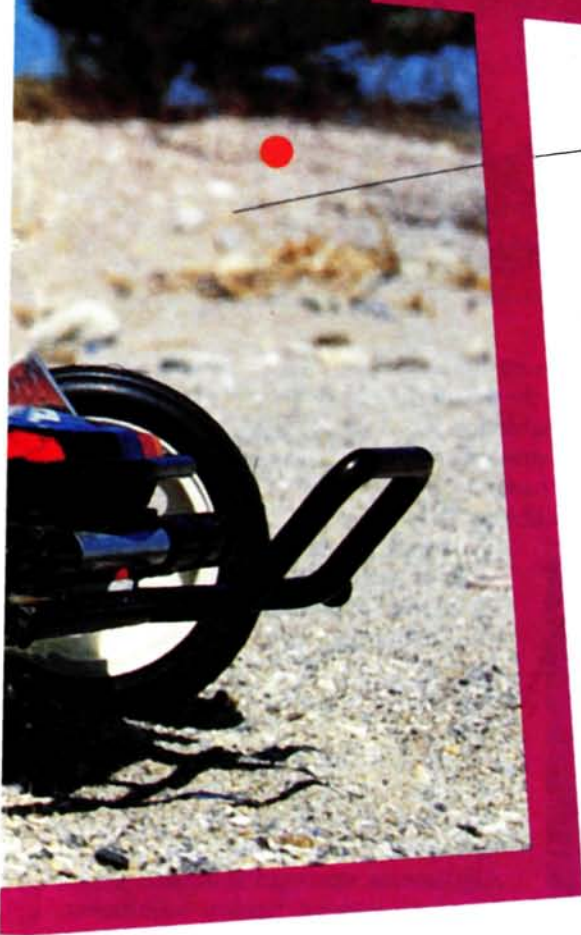


OFF-ROAD TERROR!

by STEVE POND



photos by LOUIS V. DeFRANCESCO JR.



IF YOU'VE EVER had the opportunity to visit Pismo Beach in the sunny state of California, you've probably witnessed one of the most insane forms of recreation I've ever seen. For those of you who don't know what I'm talking about, it's driving a dune buggy.

A dune buggy generally consists of a tubular steel chassis, large paddle-track rear tires, straight ribbed front tires, up to twelve high-travel shocks, and a high-performance Volkswagen or Porsche engine. Occasionally you'll see a maniac with a Chevy V-8 harnessed to his buggy. That's something like strapping a Pratt & Whitney turbine to a paper airplane.

Watching these dune buggies carve their way through the sand is nothing short of incredible. They handle the flat terrain like an Indy race car and they jump the monster sand dunes like Evil Knievel.

Using one of these sand scorers as a stepping stone, MRC-Tamiya* has designed yet another off-road R/C car, the "Wild One."

THE KIT. The Wild One has impressive features, such as four-wheel independent suspension, oil-dampened shocks, an RS-540S motor, straight ribbed front tires, oval block pattern rear tires, a ball-bearing supported gear box, and a bathtub ABS resin frame to hold it all together. You'll need to supply a two-channel radio on a frequency designated for R/C cars, and a battery pack. Use a 6-cell hump-pack, because a flat 6-cell won't fit. You'll also need a battery charger.

Before beginning construction you'll need large and medium Phillips-head screwdrivers, needle-nose pliers, wire cutters, and an X-Acto knife. All other necessary items are included in the kit. Make sure your work area is very clean to avoid losing small parts. Lay the contents of the kit out on your workbench so you don't have to fish through the box every time you need a part. There is an exploded-

The Wild One

view diagram for each step, and the more difficult steps are shown in sequence.

There are a couple of precautions to take before assembly. First, be careful when using a self-tapping screw in plastic, as it's very easy to strip. Second, read each step carefully before assembly.

CONSTRUCTION. Due to the quality of the manual, there's no need for me to "walk" you through the entire assembly. I'll just give a few pointers here and there.

The manual tackles one section of the car at a time, beginning with the front suspension (steps 1 through 6). For this sequence I have only one recommendation: before inserting the piston rod into the front cylinder in step 4, hold the cylinder upright and place a couple of drops of shock oil in the bottom. This will provide a little extra protection for the O-rings when pushing the piston rod through.

Steps 7 through 10 are the side bumper and roll bar assembly. These steps are very simple and should be no problem. Steps 11 through 13, assembly and installation of the differential, should be no problem if you follow the instructions.

The next sequence (steps 14 through 19) is the completion of the rear end. For step 16, you're given two options in the



choice of pinion gears. I tried both of these gears and found that the 15-tooth pinion gear was more suitable for recreational use. It puts less strain on the motor, which allows longer running time. If you plan to race, it would be a good

Radio used was the Technisport from Altech Marketing, the newest radio on the market. Our reviewer loved it.

idea to use the 18-tooth pinion gear.

Steps 20 and 21 are the assembly and installation of the speed controller. Prior to installing the speed controller, apply Pacer's* Rail-Zip to the contacts. This prevents arcing and allows smoother operation.

Now it's time to install the radio. I used the new Acoms Technisport pistol-grip radio from Altech Marketing*. The radio features steering and throttle travel adjustments, steering and throttle reverse switches, steering tension adjustment, steering angle and rate adjustments, back switch with travel adjustments, grip reversing, a folding antenna, and a charging jack for nickel-cadmium batteries. The radio has a very good range and smooth servo movement.



The new Model Craft charger has got to be one of the best we've used to date.

In the next sequence (steps 22 through 27), many of the steps will depend on which radio you chose, so pay attention and it should be fairly easy.

The remaining steps (28 through 38) are applying the finishing touches, like painting the body and assembling the wheels. Another nice feature of this kit is that, with very little effort, you can make your car look just as good as the picture on the cover of the box. With the exception of the driver, you only need one color to paint the body, the rest is all decals!

As far as the tires are concerned, the rims are one piece and should take about 5 minutes to complete. For a little extra security, you might want to put Pacer's Flex-Zap on the tire bead to keep the tires from peeling off the rim during hard cornering. Once these last few steps are complete, you can head for the rough country and take it for a spin.

PERFORMANCE. Before putting the Wild One through the ringer, I had to add a little life to the near-dead battery pack. I used the new model 701 Pro-Tech Super Charger from Model Craft Manufacturing*. This is the most beautiful high-quality charger I've used. It's an AC/DC charger that you can connect to your car battery or cigarette lighter. It has a 2-foot lead wire with a Tamiya connector, a two-way universal output jack, a black anodized panel, a trickle-charge light, a DC ampere meter, a 15-minute timer, a current adjust knob, a booster switch for 7- and 8-cell packs, and a discharge function.

After super-charging the battery, it was time to give this car a little punishment. After running the Wild One through a couple of battery charges, I began to think it thrived on punishment. I threw everything except the refrigerator at this car and it bounced back every time. Aside from its durability, the Wild One can smooth out the bumps and turn on a dime. If you'd like to add to the performance, MRC also offers ball-bearing kits and high-performance motors for all of their cars.


**The following are the addresses of the companies mentioned in this article:*

MRC-Tamiya, 2500 Woodbridge Ave., Edison, NJ 08817.

Pacer Technology & Resources, 1600 Dell Ave., Campbell, CA 95008.

Altech Marketing, P.O. Box 286, Fords, NJ 08863.

Model Craft Mfg., 3455 W. 6th St., Los Angeles, CA 90020. ■



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Suspension Systems

by MIKE LEE

Special Report:



Modifying the MRC-Tamiya Frog.

IF YOU'VE BEEN with me for the past couple of issues, you've noticed that I've spoken about how a suspension system works and how to get the most from a stock system. In this issue, I'll venture into modifying your present suspension and making things work even better.

I'll be using the very popular MRC-Tamiya* Frog off-road vehicle as an example. Tens-of-thousands of these cars are on the road today (or off the road in this case) and, due to this popularity, there have been many after-market items made to fit the Frog.

I've modified a Frog suspension to improve the handling characteristics for very tough track conditions. The stock suspension system works fine for most sport and competitive situations, however, this hypothetical situation will pit the car in the absolute worst off-road conditions, which call for the best possible suspension you can get.

First take a look at the stock Frog suspension and do some comparisons.

The Frog features a sprung-lever-type front suspension, which relies on the lower trailing arm to push inward on a single spring per axle. At the rear, twin rear swing arms are attached to separate oil-filled dampeners with coil-over springs. The rear dampeners can be adjusted for spring tension as well as oil weight.

In the stock form, the suspension works well and provides good ride handling for sport purposes. On the track, however, I find that high jumps and peaked moguls cause the front end to bounce on contact and, subsequently, lose steering authority. The rear end bottoms out often on the jumps and that makes chassis contact something to worry about. The standard drop test indicates a need to change the oil weight at the dampeners to prevent bottoming, but nothing can be done to improve the front end. Hence, I find I need to modify the suspension to meet the high-abuse environment.

The suspension modifications will be

concentrated on the front end to prevent bouncing, and the rear end to prevent bottoming and to get a smoother ride.

The products used for this modification were supplied by Custom Racing Products (CRP)*. CRP makes many specialized suspension parts and modification items for a number of cars. My suspension parts included the CRP Frog front shock kit with dampeners, CRP front trailing arms, CRP rear swing axle pivots, and CRP carbon-fiber axles.

Going to the front end, the CRP Frog shock kit consists of two oil-filled dampeners with coil-overs, fiberglass shock towers, and associated mounting hardware.

I began installation with disassembly of the Frog front suspension and removal of the stock springs and piston. At this time, I replaced the stock trailing arms with the CRP front trailing arms, which feature brass bearings at the pivots for smooth action and long life. Reassembly required installing the fiberglass shock towers, which mount to the front of the

inboard trailing arm bracket. The kit provides the necessary long bolts and locking nuts to mount the new tower, and the fit was perfect.

Oddly enough, the outer trailing arm bracket already has a hole drilled where the new dampeners will fit. I had to drill out the hole to $\frac{1}{8}$ inch to accommodate the shock mounting bolt, which was no problem. I attached the rest of the front end per the Frog kit, and mounted the dampeners.

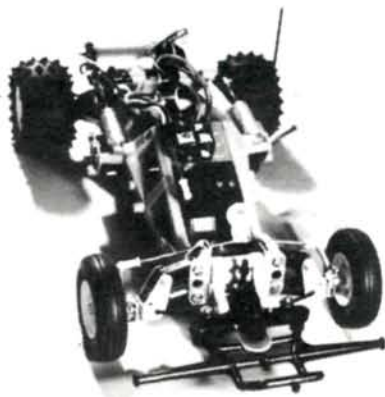
The CRP dampeners are long throw aluminum bodied units with brass pistons and drill blank shafts. I used heavy-weight oil to fill the dampeners, in anticipation of the rough track conditions.

Front shock kit action was very good and was a definite improvement over the stock spring setup. The drop test showed that the bouncing tendency was eliminated and a very smooth movement of the entire front end was evident.

At the rear end, I noted the tendency to bottom out on high jumps. To cure this I changed to a heavier-weight oil in the stock dampeners. The stock dampeners are actually very well matched to the Frog, providing good throw from their horizontal position. The addition of the heavier oil cured the bottoming symptoms of the rear. However, because the car would be subjected to heavy abuse, I decided to provide it with additional insurance in the way of dependability and longevity with CRP rear swing arm pivots.

The swing arm pivots replace the stamped aluminum pivots supplied in the Frog kit. It's easy to see that heavy abuse could score the swing arm where the pivot contacts it. That will eventually mean losing smooth movement and degrading the rear suspension. The CRP pivots are fiber-filled plastic with races molded in. The plastic is far less abrasive

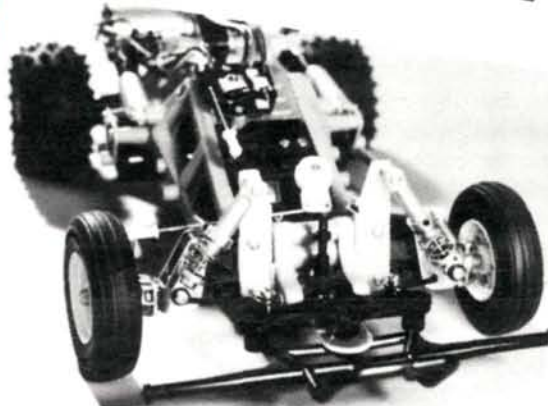
Overall view of the Tamiya Frog in stock form. Stock suspension is good for sport racing, but note lack of oil dampeners on front end.



Rear suspension pivots and oil dampeners. Dampeners from kit are very good, however, pivots are of punched aluminum and may dig into trailing arm under heavy abuse.



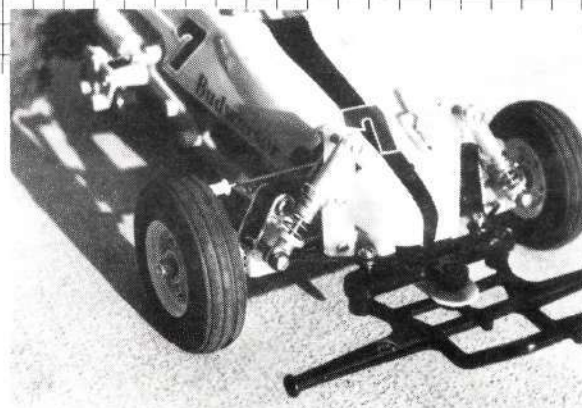
Front end showing the newly added CRP oil-filled shocks and mounting kit. New front suspension system improved front-end control and allowed better track times.



Suspension Systems



Rear pivot points show CRP replacement pivot bearings in place. These provide a larger bearing area and longer potential life under stress. Pivot movement is also smoother.



Frog off-road car with the body installed and new suspension system. No modification to the body was required to fit the new CRP suspension.

and provides a wider area of support. Inboard of the swing arm, a plastic insert is fitted into the transmission case to allow the inner swing arm to again ride on a smooth plastic surface, rather than the stamped aluminum surface.

The result of this modification was a smooth-moving swing, just like a new one. Only now, I've added to the swing arm's life by giving it a better bearing surface to ride in. That equals dependability and longevity.

The addition of CRP fiber-filled axles was my last modification. There's nothing wrong with the stock axles, but in a high-abuse environment, there could be trouble. This is because the stock axles are made of hardened steel shafts that are hexagon-shaped at each end. This provides not only a solid drive cup, but also the much-needed universal shaft movement when the swing arm moves.

The new fiber-filled axles are not only lightweight, but, because they are a plastic compound, they require less lubrication and won't wear the drive cups during use, should they run dry on grease.

So, again, the dependability of the car has been enhanced and there is less to worry about. Now, how about performance? The track test would tell.

At the track the suspension-modified Frog was a much different handling machine. It no longer rebounded on the jumps and moguls, thus providing better

steering authority and better control. The rear end also showed better performance; it rarely bottomed out and I was able to get under power faster without dragging the chassis. The lap times confirmed my visual observations: they dropped an average of about 3 to 5 seconds per lap. When you cut lap times of about 25 seconds per lap in a 4-minute heat, you can do an additional lap and a half in the same time. Think of the edge you get when the guy who beat you last

time was only a few feet ahead of you!

As you can see, suspension system modification isn't hard to perform, and it can make a big difference in the way a car performs in a given situation. The suspension system that your car comes with isn't necessarily in need of modification. Modifying a suspension should be a last resort when all other changes fail. Nothing is more aggravating and expensive than to buy the new suspension parts and find that you really did nothing to make things better, just more complicated and expensive. You should always size-up the track situation and condition the car accordingly. Chances are that most cars won't require any modifications to be competitive. But if you find that the suspension you need is not what you have, modification will be a great way to make things happen for you.

My thanks to MRC and CRP for their products and cooperation in this article.

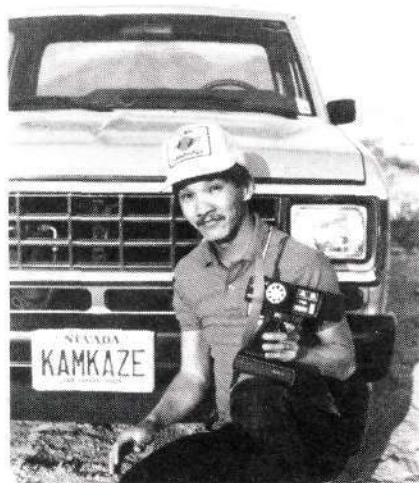
'Til next time, keep those tires in firm contact with the road.

Mike Lee, c/o Radio Control Car Action, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Model Rectifier Corporation, 2500 Woodbridge Ave., Edison, NJ 08817.

Custom Racing Products, P.O. Box 1485, Temple City, CA 91780.



Our author at large and kamikaze driver, Mike Lee. Mike says performance with the modified Frog was hair-raising.

● Track Report



A gas-
anim
wave



Kyosho. ASSAULT

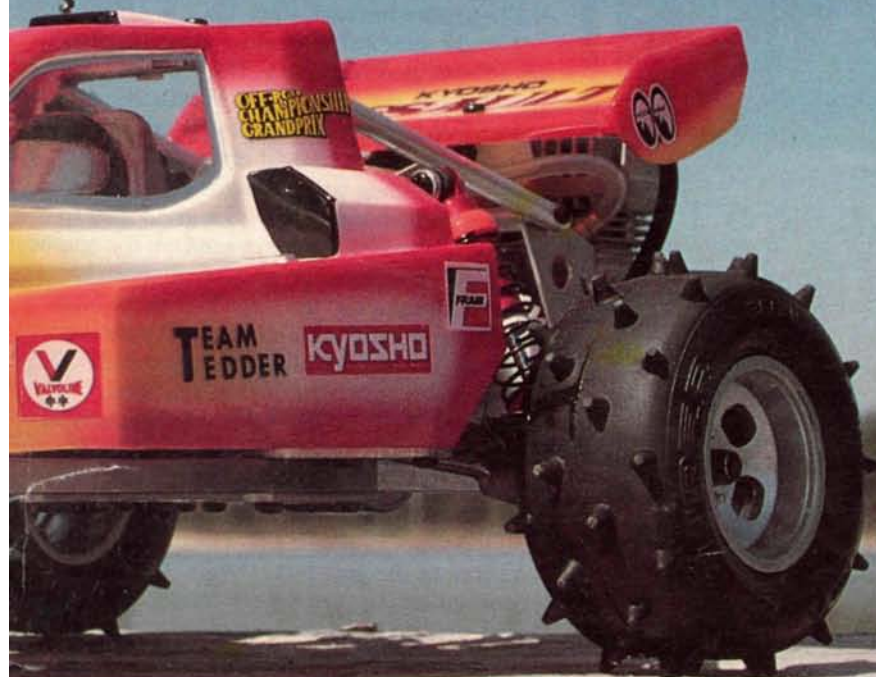
from Great Planes Model Distributors

ered 1/10
the new
R/C cars!



color photos by RICH URAVITCH

by RICH URAVITCH



THE KYOSHO ASSAULT, sold by Great Planes Model Distributors*, is one of the newest R/C gas-powered off-road machines around. It's 1/10-scale, which makes it about the same size as its less formidable electric-powered brethren. Lot's can be, and has already been, said about the advantages and disadvantages of gas versus electric power. In fact, I've said some of it myself.

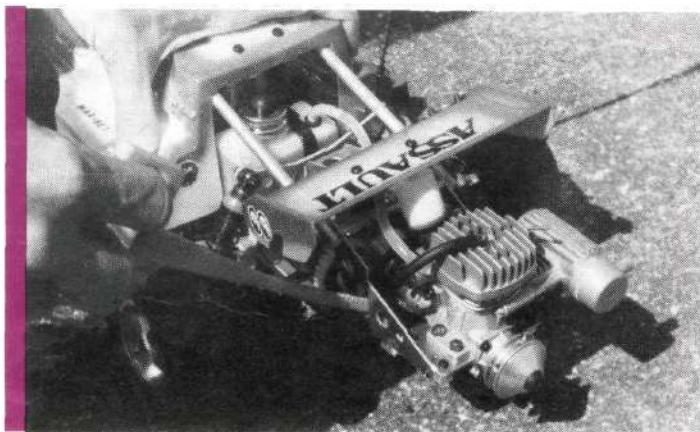
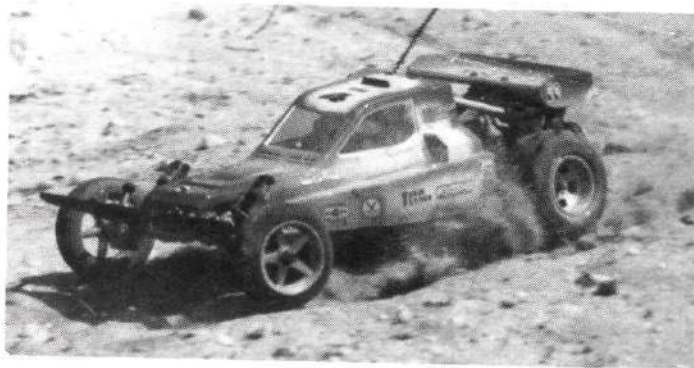
I strongly suspect that the 1/10-scale car in general will end up as the most widely accepted of the breed. The larger 1/8 gas killers require .21 size engines, which are better than twice the displacement of the O.S. .12 included in the Assault kit. They are more costly to

own and operate, requiring additional equipment, such as electric starters, separate ignition batteries, and considerably more space if you use all their power potential.

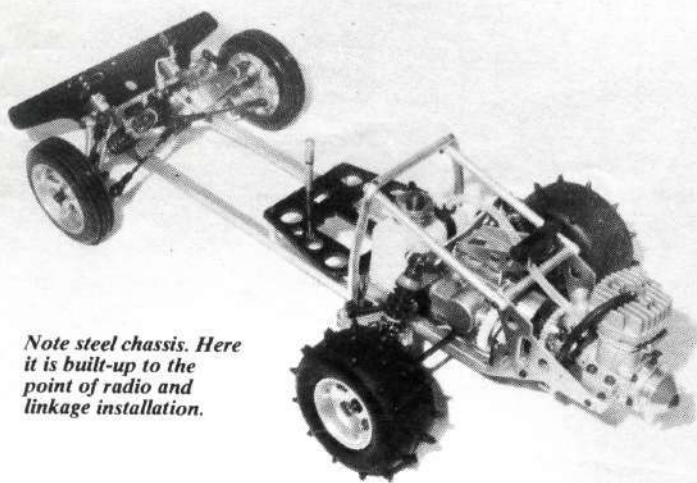
THE KIT. Upon opening the kit box, you'll notice that it's packed with nearly everything you'll need to complete your Assault, except paint and radio equipment. A completely illustrated, 16-page assembly manual takes you through the build-up process step-by-step. A spare parts ordering guide is included.

Before starting actual construction, familiarize yourself with the assembly sequence by locating the called-for parts. All the parts, although neatly bagged,

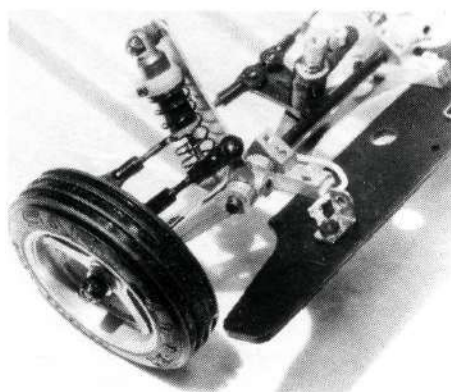
ASSAULT



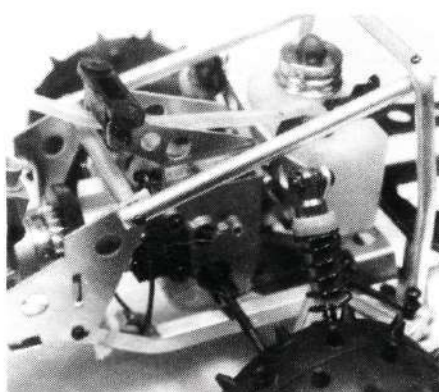
Zip-Strip starting technique works great.



Note steel chassis. Here it is built-up to the point of radio and linkage installation.



Front suspension, rugged and fully adjustable.



A rear suspension with relocated shock upper attach point. See text.



Polycarbonate body parts after airbrush painting at "sponsor billboarding."

are *not* bagged sequentially, which means you might have to open two or more bags to gather the required parts to perform a particular step.

Separate all hardware (screws, nuts, washers, bushings, etc.) by size. Put them into a marked container, such as an egg carton. This will eliminate the need to dig through all the hardware for each step.

Use the supplied screw-locking compound on all indicated hardware. The vibration and hard knocks the Assault will eventually see will loosen everything possible, and even some things you'd have thought impossible.

When building up the engine flywheel/clutch assembly, it's a good idea to use the screw-locking compound on the engine shaft and to tighten the pilot shaft securely; make certain to use the large E-ring to retain the clutch assembly on the shaft. It's shown installed in the illustration, but no specific instruction is provided. It's easy to miss.

CONSTRUCTION. Assembly begins with building up the basic frame by attaching the various plates and brackets which will eventually become suspension mounts. After you get through the first five steps and before you mount the gear box, remove the side cover and make sure the setscrew holding the bevel gear on the shaft is in place and tight. I didn't care for the way the rear shocks were

(Continued on page 110)

Engine Review

O.S. MAX-21 VF-B

by PETER CHINN



Hot new O.S. Max-21VF-B off-road car engine comes complete with large and essential air cleaner.

SPECIFICATIONS

Type: Air-cooled, single-cylinder, rear-exhaust two-stroke, with crankshaft rotary-valve and Schnuerle scavenging.

Bore: 16.6 mm (0.6535 in.)

Stroke: 16.0 mm (0.6299 in.)

Displacement: 3.463cc (0.2113 cu in.)

Nominal Compression Ratio (full stroke): 11.0:1

Speed Control: O.S. Type 2K adjustable automatic mixture control carburetor

Checked Weights: 312 grams (11.0 oz) less air cleaner; 346 grams (12.2 oz) with air cleaner

Mounting Dimensions:

Crankcase width: 30 mm

Length from prop driver face inc. exhaust adaptor: 92 mm

Height above CL: 75 mm

Bolt hole spacing: 38 x 15 mm

Manufacturer's Claimed Power Output: See text

Manufacturer: O.S. Engine Mfg. Co., Ltd., Higashiumiyoshi-ku, Osaka 546, Japan.

U.S. Distributor: Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.

THIS NEW high performance 3.5cc class model car engine from O.S. has been specially developed for off-road racing and "buggy" (hence the "B" suffix) type vehicles. Outwardly disguised by a new and distinctive cylinder head and by the big air-cleaner that is supplied with it, it is, in fact, a specially modified version of the Max-21VF-C track car engine.

The Max-21VF-C, introduced just over three years ago, was dealt with in the "Engine Review Round-Up" series in the May 1983 issue of *Model Airplane News*. We shall not, therefore, repeat our earlier detailed description of the engine's design, but will merely recapitulate the more significant points before covering the special features of the Max-21VF-B.

Basically, of course, the 21VF is one of the front runners in the O.S. line-up in terms of specific output. The 21VF-C is nominally rated at 1.10 bhp at 26,000 rpm without tuned exhaust assistance and, having similar porting and the same carburetor choke area, the new 21VF-B can be expected to deliver similar power.

Features common to both engines include Schnuerle scavenging with twin third ports; a thick-walled non-ferrous

liner having O.S.'s special extra hard, low-friction, all-over composite plating; an extremely well-fitting ringless piston; a sturdy bar-stock conrod with bronze bushes at both ends; a heavily counter-balanced crankshaft with extra large front ball bearing (9x20 mm) and 12x24 mm rear bearing and a lengthy rotary-valve period extending from 35 degrees ABDC to 64 degrees ATDC.

The actual component parts of the 21VF-B that are not common to the VF-C include the piston/cylinder-liner assembly, the cylinder head and the carburetor. The new Type 2K carb fitted to the 21VF-B has a modified body and lengthened throttle barrel, the outer end of which is covered by a rubber bellows type dust cover. The needle-valve is integral with the carburetor, instead of being mounted remotely from it as in the case of the 21VF-C. The effective choke area remains unchanged at a generous 38 sq mm.

A rather ingenious solution has been found to the problem of presenting the vertical head fins end-on to the airstream, irrespective of whether the type of transmission used requires the engine to be mounted on the chassis with the crankshaft located longitudinally or across the

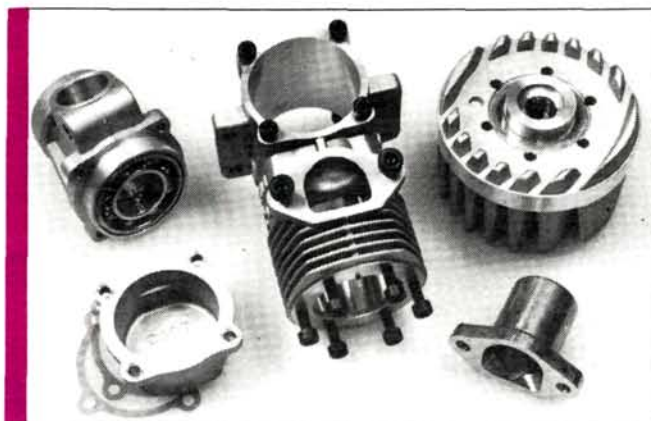


Max-21VF-B is development of 21VF-C track car engine. Note new curved-fin head and special Type 2K carburetor.

frame. Since six screws are used to secure the head, it is not possible to rotate the head through 90 degrees. Therefore, the head fins are curved in such a way that a 60 degree rotation has the desired effect. The fins themselves are nicely tapered and the overall impression is an improvement in the appearance of the engine. The reason for adopting this type of finning, rather than horizontal finning (which, of course, does not require the head to be turned) is probably more than just cosmetic. Horizontal finning on a heat-sink type head has the effect of shrouding the glowplug body in a long vertical tube, whereas vertical finning admits a free flow of cooling air right across the head.

The use of a carburetor air filter is always desirable on a car engine but is absolutely vital for dusty off-road work. With each Max-21VF-B, the O.S. factory is including a large plastic-bodied air cleaner of the replaceable element type. It is supplied with one large and one small element (plus two spares) that can be used in different combinations according to the severity of operating conditions.

Peter Chinn, c/o R/C Car Action, 632 Danbury Rd., Wilton, CT 06897. ■



Max-21VF-B castings display usual O.S. high quality and excellent finish. Ball bearings include oversized front end bearing.



Other Max-21VF-B components: specially coated liner, perfectly matched ringless piston, sturdy crankshaft, hefty conrod and precision-made carb parts.

Associated Electrics

by MIKE LEE

RC12i

i

N TODAY'S

world of high technology, it's hard to resist a good-looking, high-powered race machine. You instantly

begin to dream about the big names: Porsche, Ferrari, Lotus, Alfa, etc. They're exotic and fast, and they bring forth visions of high-speed utopia.

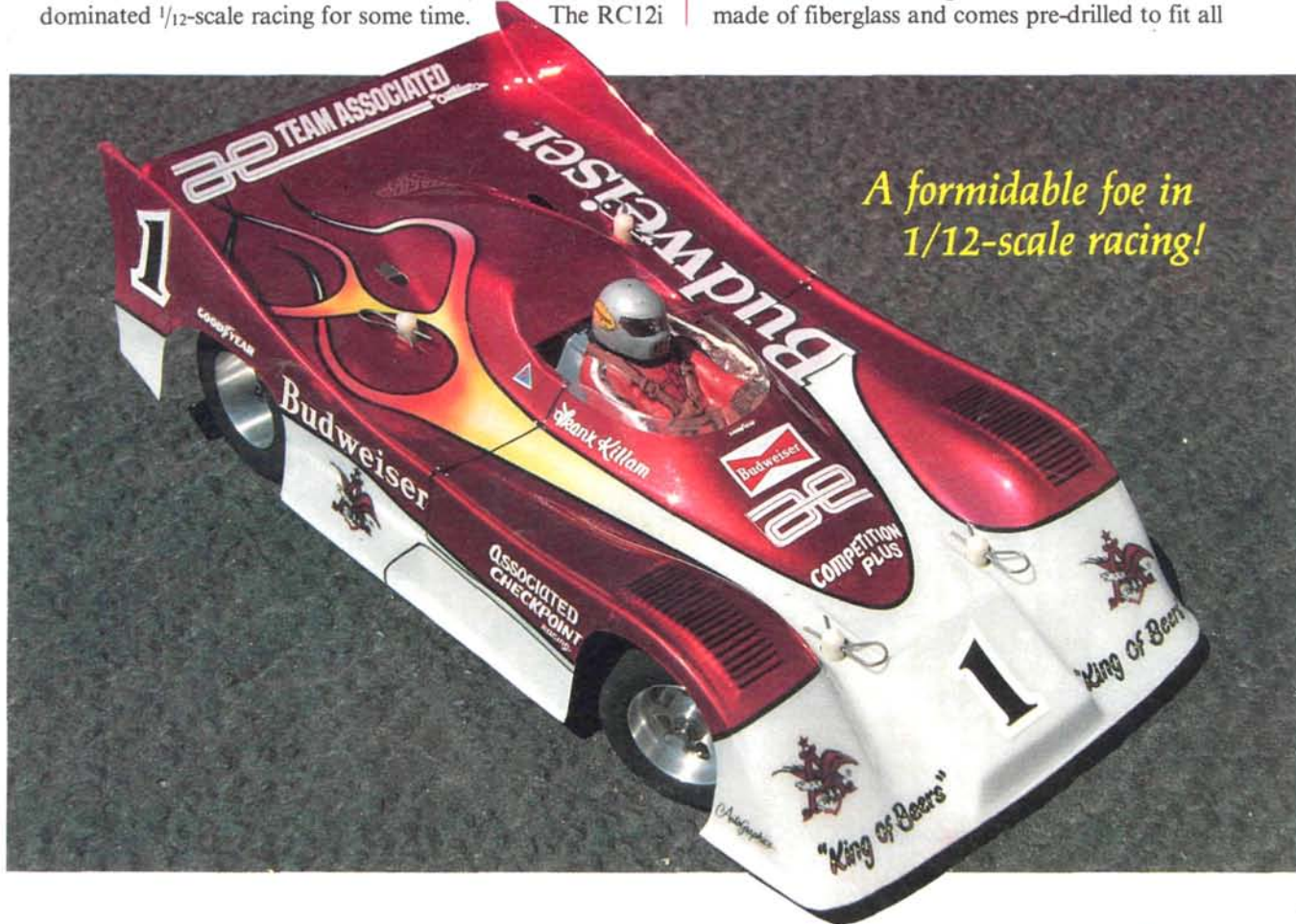
If you're like most mortals who have a limited budget, you've probably been relegated to Volkswagens and the like, unless you're into R/C racing. This Road & Bench Review takes a look at high speed and its technology in Associated's* RC12i electric road racer.

The RC12i isn't really a newcomer to road racing; it's a direct descendent of the famous RC12e, which dominated 1/12-scale racing for some time. The RC12i

represents a big step forward in design and sophistication. Let's look under the hood of this thoroughbred car.

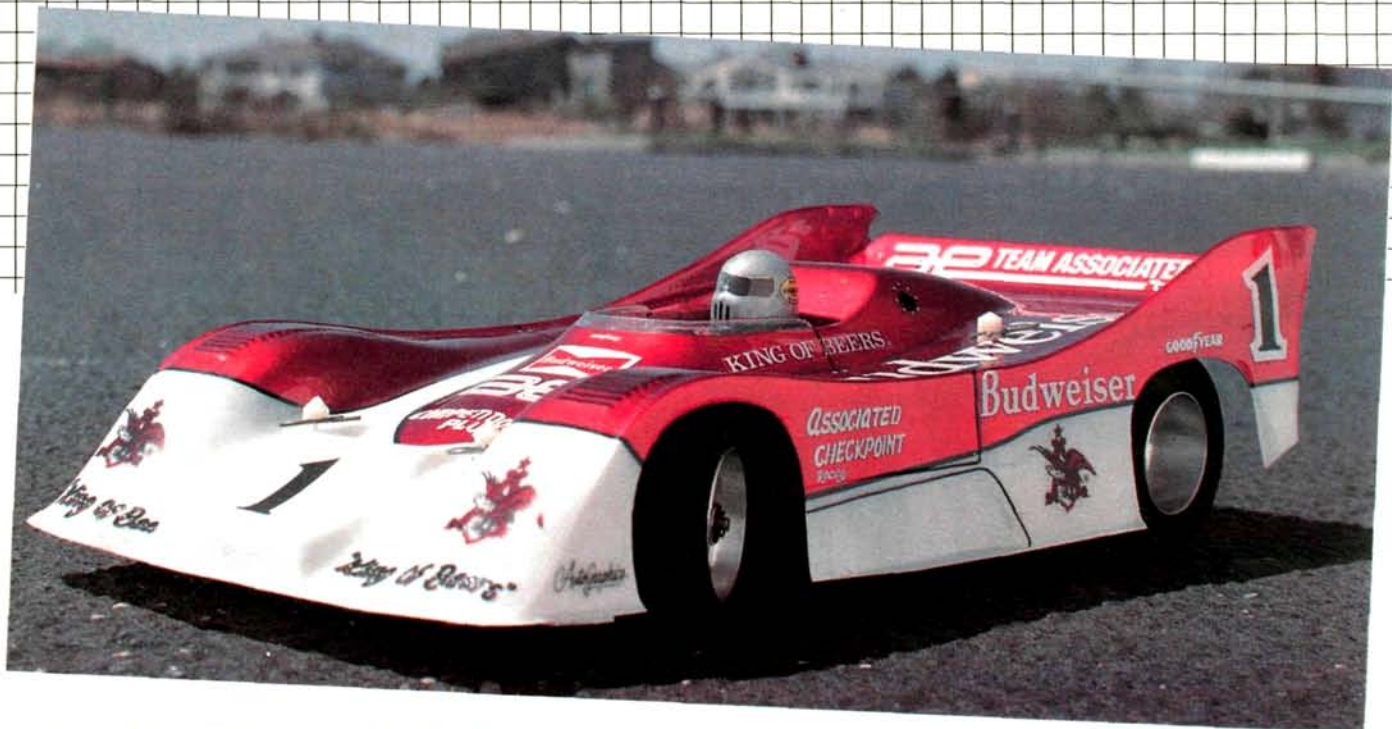
THE KIT. To assemble the RC12i you'll only need a soldering iron and basic reading skills. The car comes in a box packed full of baggies holding everything you need to complete a race-ready car. The RC12i is available in several different kit forms, from basic chassis and suspension to a fully-assembled ready-to-run version. My kit featured a full production kit car with all upgraded options for suspension and a Lotus T-600 body.

ASSEMBLY. Begin with the basic chassis, which is made of fiberglass and comes pre-drilled to fit all



*A formidable foe in
1/12-scale racing!*

color photos by LOUIS V. DeFRANCESCO JR.



subassemblies. All holes are drilled through the chassis bottom and are countersunk to allow flush fitting of screws and bolts. This makes for a very clean chassis bottom.

There is little to do to prep the chassis, except for attaching a carbon fiber stiffener to the mid-section for strength. I used Satellite City's* Hot Stuff adhesive for a quick job.

Front-end assembly is next, and this is sophistication at its best. The front-end suspension is a single mono-shock design incorporating an Associated oil-filled dampener. Front-end tension is accomplished with a strong return spring on the dampener shaft, aided by a torque rod.

Front suspension arms are fully articulated with adjustable camber, caster, toe-in, and toe-out. Caster adjustment is done using angled shims under the suspension mount.

All front-end tie-rods feature nylon and steel ball links for fine adjustment, as do the steering tie-rods. The front-end is rounded off with a polystyrene nose bumper that will take an act of Congress to break apart. Front wheels are mounted in Oilite bronze bearings.

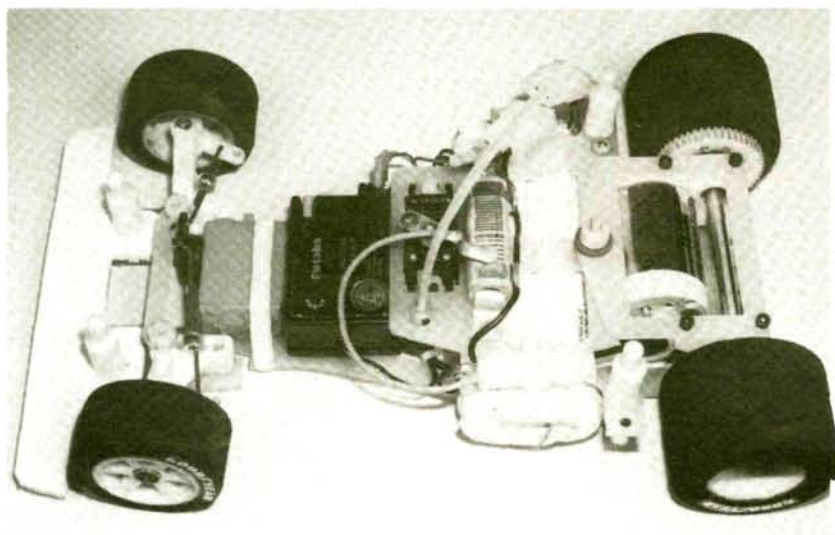
Moving to the rear end, you find more sophistication. The rear axle is made of carbon fiber graphite, and is extremely light and strong. Mated to the rear axle is

Associated's own "Vari-Diff" ball differential on the drive side of the axle. The Vari-Diff provides effective differential action on the rear wheels, affording

(Continued on page 111)



Radio used with the race-winning RC12i was the incomparable Futaba Magnum Junior, a great combination.



Note proven flex chassis design of the RC12i. Car is a super handler.



New quick charger from Associated provided plenty of juice.

Track Report



*It's so fast, you'll definitely
need wings!*

Kyosho

I · C · A · R · U · S



From Great Planes Model Distributors

by CHRIS CHIANELLI

FOR THOSE OF you who don't know, Icarus is a figure from Greek mythology. Icarus' father Daedalus constructed wings from feathers and wax so he and Icarus could escape from the island of Crete. Icarus, being young and strong, flew with alacrity and strength to great heights. He flew so high, in fact, that the sun melted his wax wings and he fell into the Icarian Sea.

Kyosho, by way of Great Planes Model

Distributors*, has made the second coming of Icarus bug-free, powerful, and economical. In place of wax wings, you get a high-performance LeMans 360ST motor. Kyosho might be changing the standard for an out-of-the-box car by including the 360ST motor at no extra charge. As you may or may not know, the large majority of cars, including cars costing more than the Icarus, come with the Mabuchi 540 series motors. The 540 is a proven powerplant, but it just can't compare with the souped-up, high-torque 360ST. The fact that Icarus is one of the three fastest cars I've ever tested is proof.

THE KIT. Considering the fact that this car is one of the fastest stock cars on the market, it has a relatively low list price. One way Kyosho accomplishes this is with the use of a complex, one-piece, molded bathtub-style chassis. In no way has the car been skimmed on. It has features such as high-quality aluminum, not plastic, shocks; automotive type differential; and extremely high-impact, molded components, including a full roll cage. At one point, I forgot to extend the antenna on the transmitter. Icarus got up a full head of steam in the parking lot, got out of range stuck in high throttle, and smashed head-on into a curb. The car flew 10 feet in the air. Louis DeFrancesco made a noise as though he'd been punched in the stomach, because we hadn't taken any photos yet. Both of us expected to find an Icarus tossed salad. Instead we found no damage except a bent antenna rod and some scratches on the bottom of the chassis.

CONSTRUCTION. Assembly is probably simpler than most of your average R/C cars, partly due to the one-piece frame. All you need are standard screwdrivers, pliers, cutting blades, scissors, etc., and don't forget to use Pacer's* Zap Lock (the blue label) on all the screws and



New Kyosho Auto Charger is a great charger with all the bells and whistles.

nuts. I'm never without this product, because it really holds things together.

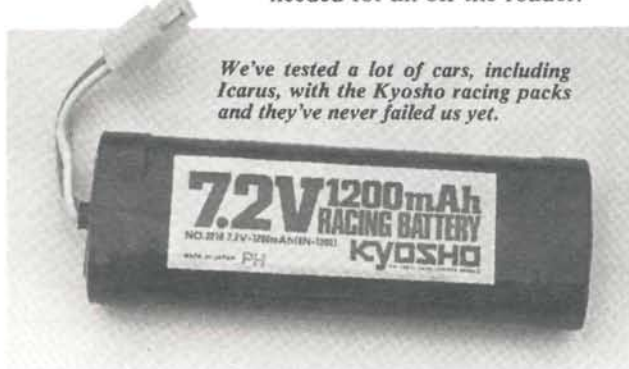
Kyosho also includes an extremely clear instruction booklet with many diagrams to ease assembly.

In addition to breaking-in the motor for three hours in each direction, I also broke-in the differential with dental polishing paste. Toothpaste works well also.

I can't say for sure how much this helped, but the differential certainly turned smoothly.

Another nice feature is the bottom access for the battery, which makes it very simple to recharge.

RUNNING. As for performance, I've already mentioned that Icarus has much better than average speed. The handling was also quite steady, partly due to the excellent dampening qualities of the high-quality adjustable shocks and the suitable suspension travel needed for an off-the-roader.



The Kyosho Icarus is definitely going to give the competition some reason for concern. It's definitely competition-worthy and it's definitely affordable. Incidentally, I've already ordered a set of ball bearings for an even higher speed crack at the Parking Lot Curb Smasher's world record.

**The following are the addresses of the companies mentioned in this article:*

Great Planes Model Distributors Company, P.O. Box 4021, Champaign, IL 61820.

Pacer Technology & Resources, 1600 Dell Ave., Campbell, CA 95008. ■

Track Report



ゼルダ

ZERDA

from circus hobbies

by FRED MURPHY

THE HIROBO ZERDA, distributed by Circus Hobbies, could be called "boxed lightning." It is lightweight, quick, sure-footed, and easy to assemble. In a matter of two and a half hours I had a race-ready buggy, designed around a large ski-type chassis. The assembly consists of fourteen steps, which mainly revolve around loading the radio system components. The radio I used was the Circus JR Pro pistol-grip system, from the Circus Winner Series. It provided a great combination for easy radio system fit and great buggy control.

The 3.6-pound Zerda is powered by a Mabuchi RS-540S motor, which provides a strong stock class powerplant you can use to run with the big boys. The use of a new high-impact plastic design in the major chassis and body components allows this buggy to be one of the lightest out-of-the-box 4WDs I've ever seen. Keep in mind that the Zerda is factory pre-assembled; you only have to install electrics and go racing.

The RS-540S and factory-installed 7.3:1 gear ratio allowed me to cover good ground, but Hirobo has also provided a 16-tooth motor pulley, giving a 7.8:1 ratio if you want to get there a little more quickly. The best surprise of all, no matter what ratio I used, was the Zerda's quick-off-the-line power transfer and braking ability. This can be attributed to a power transmission using a timing belt system. The belt-drive system not only provides a smooth and quiet drive, but also quicker acceleration and improved braking over the traditional shaft and

A great new off-road warrior from the Hirobo gang.



This is how the Zerda comes out of the box. It's just a matter of radio installation, tightening all nuts and bolts, and painting the driver. Then it's off to the races!

chain-drive systems. Although the wheels do get power transmission from drive shafts that are bearing-supported from the factory, the belt system that gets the power to the shafts provides an outstanding performance combination.

Coupled with this great drive system is the Zerda's four-wheel independent semi-double wishbone suspension, which gives good road surface contact under very hard cornering and some relatively rough terrain. The independent suspension allows adjustment of coil-over spring tension on 10-mm diameter oil dampers, so you can fine-tune for any track condition. As a nice addition, the suspension even allows camber adjustment of the double wishbone on all four corners. The capacity oil damper with adjustable coils

helps ensure the best running ability on all kinds of surfaces.

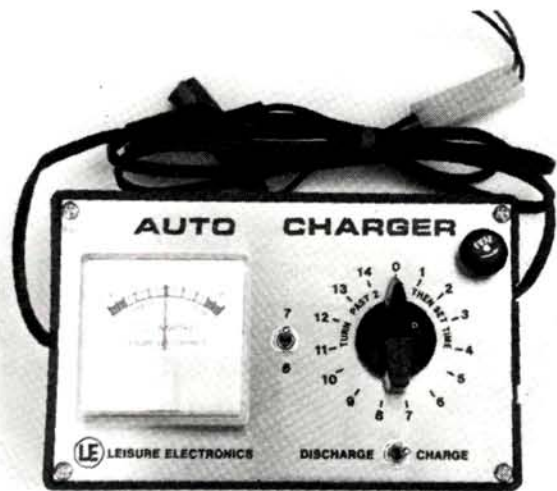
The heavy components, battery and radio gear, are placed at a low position in the body to ensure a good CG for improved jump control and weight balance.

The Circus JR Pro pistol-grip proved to be a pleasant addition to the Zerda. It was

easy to handle in weight and balance, and provided good response to a very responsive buggy. (For more detailed information on this radio, see Charlie Kenney's review elsewhere in this issue.) The trigger was accurate in forward and reverse throw. This radio has all the features and reactions of much more expensive systems I've used. The servos and mini-receiver are a perfect match for the Zerda, and made for a smooth assembly.



Our reviewer attests to the great quality of the new Winner trigger radio from Circus Hobbies.



High-quality auto charger from Leisure Electronics provided plenty of "zap" for the battery pack. Leisure has a complete line of charging accessories.

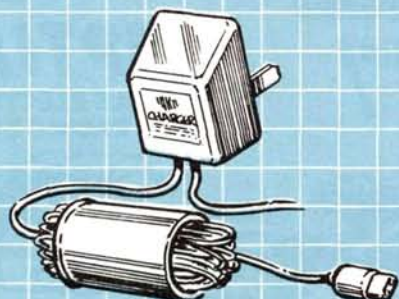
Keep an eye on the Zerda. It could be a surprise contender in its class.

**The following is the address of the company mentioned in this article:*

Circus Hobbies, 3132 S. Highland Dr., Las Vegas, NV 89109.

Pit Tips

by JIM NEWMAN



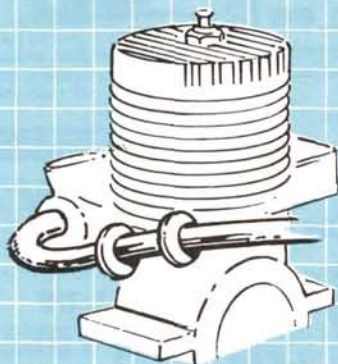
Long charging cords lead to tangles and frustration. Cut the bottoms from a pair of plastic 35-mm film cans, coil the cords as shown, then stuff them through the cans, leaving the desired amount protruding. Neat and very effective!

Roger Christie, Oak Park, Illinois



Removing the rear wheels of dune buggies—like the Tamiya Rough Rider, for instance—can be a little tough on the thumbs. This modeler places a coin—a quarter does nicely—on top of the axle, then applies his thumbs to that, after which the wheel pops off with no pain!

Ronnie Tang, Vancouver, B.C., Canada



Prevent melted fuel lines by slipping a couple of appropriate size washers over the tubing to act as spacers and to keep the tubing from the hot cylinder. A ball point spring will also work.

Brent Robert, Kensington, Maryland



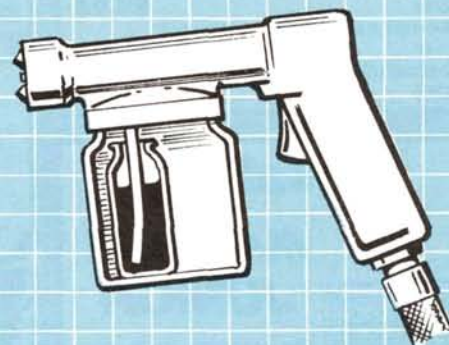
Notching the exhaust stack on some engines allows very easy access to the mounting screw heads.

Karlos Busvek, North Hollywood, California



Foam cups, cut as shown by the dotted line and glued into your race car, will keep dirt and dust from the interior.

Walter Weigel, Poughkeepsie, New York



If only a very small quantity of paint is required, the spray gun's dip tube often will not pick it up. Put the paint in a small bottle which, in turn, is placed in the gun's paint container. The dip tube will keep it in place.

Paulo G.D. Salvado, Bahia, Brazil

Radio Control Car Action will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Pit Tips." Send rough sketch to Jim Newman, c/o **Radio Control Car Action**, 632 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

Track Report

GR

From P

by BILL LANDAN

I'VE ALWAYS BEEN IMPRESSED by 1/4-scale models, but to experience 1/4-scale in an R/C car is really something.

Once you get over the awesome size of the true 1/4-scale Grizzly from Pacesetter Products*, you'll be impressed at the beefy construction. The suspension arms are machined from aircraft-grade aluminum castings and the robust frame rails make it evident that this is one tough bear.

THE KIT. A closer look reveals the adjustable suspension. Besides the normal adjustment for front toe-in and toe-out, the rear is also adjustable for toe-in. You might wonder why you would want to adjust the rear toe-in, but on an independent suspension car it's quite an advantage to be able to put 1° to 1½° toe-in to correct power oversteer.

This adjustment is accomplished by an elongated hole on the outside pivot pin bracket and spacers for keeping the dog-bones with normal end play. Another useful adjustment is for camber.

The Grizzly is 38 inches long and 21½ inches wide. The wheelbase is 25 inches with a 19-inch front track and an 18-inch rear track. Front and rear tires are mounted on 3⅞-inch diameter spun aluminum wheels and are 6¼ inches in diameter by 2 inches wide and 7¼ inches in diameter by 3¼ inches wide respectively. Ready-to-run weight with the 2-cubic-inch, 2-horsepower McCullough engine is 22 pounds.

CONSTRUCTION. Assembly starts at the rear by sandwiching the rear frame rails with the engine plate and skid plate. Mounting these to the frame rails makes a strong platform for the engine, final drive, and rear suspension pick-up points. The final drive, which is assembled for you, is installed on the skid plate at this time.

Moving to the front of the car, assemble the cross-member with the hinge pin and clamps. Don't tighten the clamps now, because later you'll adjust the front camber by moving the hinge pin.

The roll cage is a TIG welded aluminum assembly with six attaching points. I painted my roll cage, but you can leave it as it is or polish it with semichrome (available at auto parts stores) to give it a chrome-plated appearance. You can install the roll cage now, but before fastening the two front legs of the cage, install the radio tray, which shares the fasteners with the cage's front legs.

Assemble and mount the rear suspension arms, which are the A-frame type and are made of cast-aluminum. Sealed ball bearings are supplied for the axles to ride in. The arms are held to the chassis by ¼-inch pins at the rear of the motor plate. Make sure the dog-bone axles are inserted first, before final assembly.

Assemble and place the front suspension arms. Again,



these are cast-aluminum trailing arms. The front end features castor locks for fast adjustment of castor geometry, and a simple setscrew arrangement is provided. The shocks can be mounted on the front and rear; take care not to over-tighten the bolts that secure the shocks. Absolute freedom is a must for good operation.

THE [ZZLY

esetter Products



Mount the tie-rods, followed by the front bumper and control links. For the most part the front end is finished.

Now install the engine and primary chain. The chain should not be tight—there should be about $\frac{1}{4}$ inch of up and down movement. Assemble and install the gas tank now. It's supplied

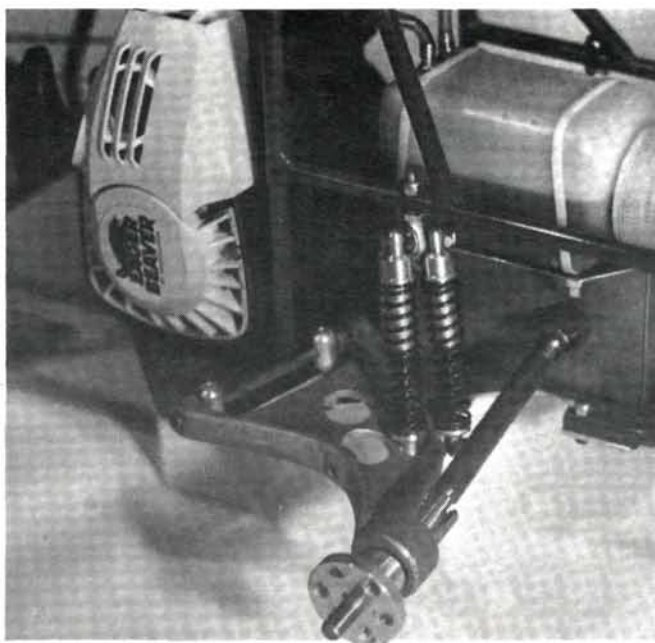
with three brass fittings: one for the pickup, one for the vent, and one for a fill. The tank is also supplied with a clunk filter arrangement. Make sure that the clunk lies flat on the bottom of the tank. If you get sloppy with the filter, your car will not run even though you still have an inch of gas remaining in the tank.

THE GRIZZLY

From here on out is pretty simple; it's just like setting up a 1/10-scale car, except everything is larger. There are, however, a few precautions to consider with radio equipment. In the past I've noticed interference with ignition engines and receivers on 27 MHz. I recommend using a radio on the 75 MHz band. You should also use the most powerful servos that are available for your radio system, such as the Futaba S-134 and S-34, or World S-16. The steering servo lies flat while the throttle and brake servo (one) stands up. The brake is a direct hook-up, while the throttle must have an override.

The body is fiberglass, which is a departure from most R/C cars, but you'll find it easy to finish. All gel-coated fiberglass parts have wax on them that must be sanded off. I recommend 400-grit wet-or-dry sandpaper. Once you've thoroughly sanded the body, apply a coat of primer, which will make your finish color stick better. For the finish I used automotive touch-up paint. This comes in lots of colors, including metallic, and is available in spray cans.

When you've finished the body, it's ready to mount. The kit comes with Velcro, which is great for fastening on the body. The vibration associated with single-cylinder gasoline engines sometimes hollows out mounting holes, but the Velcro will isolate the body from any vibration, and it just rips off for easy access to the innards.



Twin rear shocks and adjustable rear toe-in make the Grizzly an extremely durable and maneuverable 1/4-scale machine.

The front hubs have two ball bearings pressed in and the hub assembly and spindle are locked to the spindle block with a jam nut. A few extra minutes adjusting the spindle and lock nut are well spent here. If there isn't enough free play, the bearings will be placed in a bind. If there's too much play, the front wheels will wobble. The rear hubs have a keyway that works with a woodruff key in the axle. The hub is held in place with a nut, but wait to place it until the rear wheels are put on. It's a

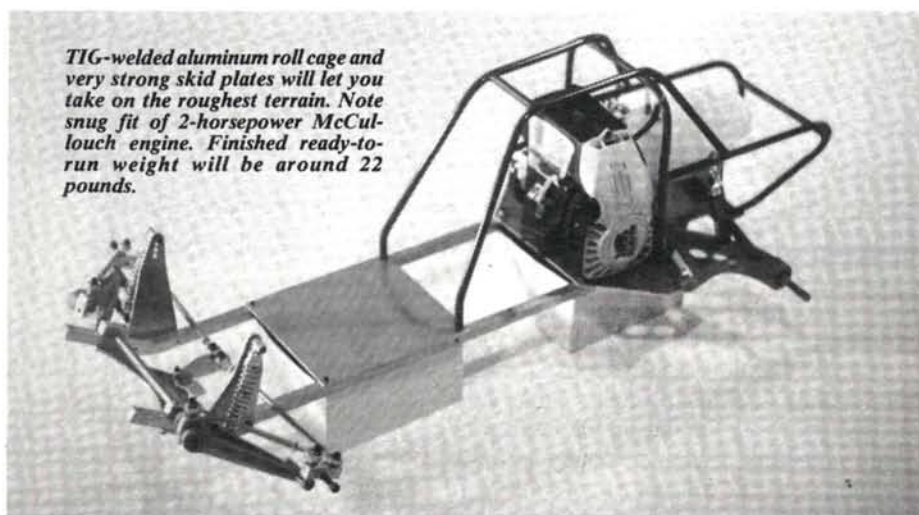
good idea to glue half a wheel into each rear tire and it isn't necessary to glue the fronts. Once the glue has dried, line up the other half with the holes and bolt the wheel halves together. Now you can mount the wheels on the hubs.

PERFORMANCE. By now you're probably dying to have the Grizzly on its wheels—don't wait any longer. The Grizzly is truly an awesome machine, not only in size but in performance as well. I've been running glowplug model airplane engines for the past 14 years and to say they can be temperamental is an understatement. The chainsaw engine is such a pleasure to start; put the choke on, give a couple of pulls on the recoil starter, and you're running.

Acceleration is strong and constant and, if given enough room, the Grizzly could easily surpass 50 mph. If you want it to, the Grizzly will idle down and just putt around the yard, but it really shines when the terrain gets rough. Like it's namesake, the Grizzly loves the rough backwood!

**The following is the address of the company mentioned in this article:*

Pacesetter Products, Garner Valley Box 257, Mountain Center, CA 92361.



TIG-welded aluminum roll cage and very strong skid plates will let you take on the roughest terrain. Note snug fit of 2-horsepower McCulloch engine. Finished ready-to-run weight will be around 22 pounds.

Track Report



VARICOM MUGEN BULLDOG II 4WD

by ART SCHROEDER

MANUFACTURERS have a propensity for naming various land and air machines after animals of one kind or another, in an effort to indicate that their products run or fly like their zoological namesakes. You often see Jaguars, Falcons, Eagles, Wildcats, Mustangs, or Panthers; even the lowly Caterpillars, Frogs, and Gnats have been so honored. The list is endless and it is hoped, by PR types, that the names selected will conjure thoughts of power, speed, performance, and beauty in potential customers' minds.

So, enter another animal namesake—the Mugen Bulldog II, distributed by Varicom Industries*. Webster tells us that the bulldog is compact, muscular, and marked by vigor and sagacity. Just opening the big box of parts from Mugen made me feel that this new R/C off-roader was well named; subsequent running proved

The Bulldog has evolved into a wild Samurai pit bull!

it. The Bulldog II is surely compact and muscular, and it did run with vigor. (I proved to be the sagacious one for doing this project.) One thing in this name is in error however, the Bulldog is definitely *not* a "dog"!

The latest Mugen offering is based on Bulldog I that Dan Landan covered in the premier issue of *Radio Control Car Action*. The chassis and running gear appear to be identical in these two Bulldogs, so you might want to look at the first review for information on these items. Since the Bulldog I used a cage-type body and II uses a full body with wing, there have been some minor changes to mount the plastic enclosure.

THE KIT. As with all off-road cars I've reviewed, the strong points of this Mugen car are its beautifully-made, finely-finished, perfectly-fitting parts and a set of flawless instructions. All parts are keyed to the instruction manual. The car can even be assembled by a first-time builder if he can read and handle a screwdriver, a pair of pliers, a soldering iron, and a hobby knife. There's simply no way to go wrong if the instructions are carefully followed in sequence and if the various parts are kept available in an organized fashion. I suggest you review my article, "Building Your First R/C Car," in the Winter 1986 issue of *Radio*

BULLDOG II



Above: The Bulldog is extremely fast and stays level in flight, as evidenced by this photo. Below: State-of-the-art Airtronics XL2P radio was used.

Control Car Action for some insight on how to get started.

CONSTRUCTION. If anything, assembling Bulldog II is easier than the first version since all three differentials are completely assembled and only need be installed with the cog belts in the main frame. Some adjustment of the differentials will probably be needed, but the instructions fully cover this task.

The first cardinal rule to follow when assembling a car of Mugen's high quality is, "If something doesn't fit or doesn't work correctly, *you did something wrong*—reread the instructions!" The second cardinal rule is, "Don't lose any parts, screws, or nuts—there are usually just enough to do the job!" Frankly, that is the only criticism I had for the Mugen kit; the parts count is perfect and I would have been more comfortable with a few extra screws, bolts, nuts, and, most importantly, C-clips. I lost one C-clip and spent nearly as much time looking for it as I did assembling the chassis.

The car is powered by a Mabuchi RS-540S motor and I found mine considerably improved after an hour of break-in time. Much has been written about break-in, but I find a simple attachment to a 7- to 12-volt power source with the motor held lightly in a vise to be a simple, effective way to break it in. I use a couple of styrofoam pads to avoid any undue pressure on the motor case. Free running doesn't seem to generate excess heat and it sure runs those brushes into a "loving" relationship with the commutator. I run four or five 10- to 15-minute segments and then I mount

the motor into the car. Free running is followed by three or four 10-minute segments in the car using the 7.2-volt power pack. Just prop it up so the wheels are free and go at it in high speed. The latter procedure frees up all moving parts and, if you then adjust things (belt tension, motor position, gear adjustment, differential), your running gear will be ready for the road and everything will be nice and free. A drop of high-quality machine oil on wheel bearings and other strategic spots helps—just don't get oil on the motor commutator and brushes. Only a drop is needed on any oiled moving part; more than this merely attracts dirt.

The Bulldog II body is a clear plastic molding that is best prepared by cutting

(Continued on page 107)



The economical Multi-Charger from Kyosho proved to be as effective as some of its high-priced competitors.

Track Report

**The Hornet will deliver
one lethal sting!**

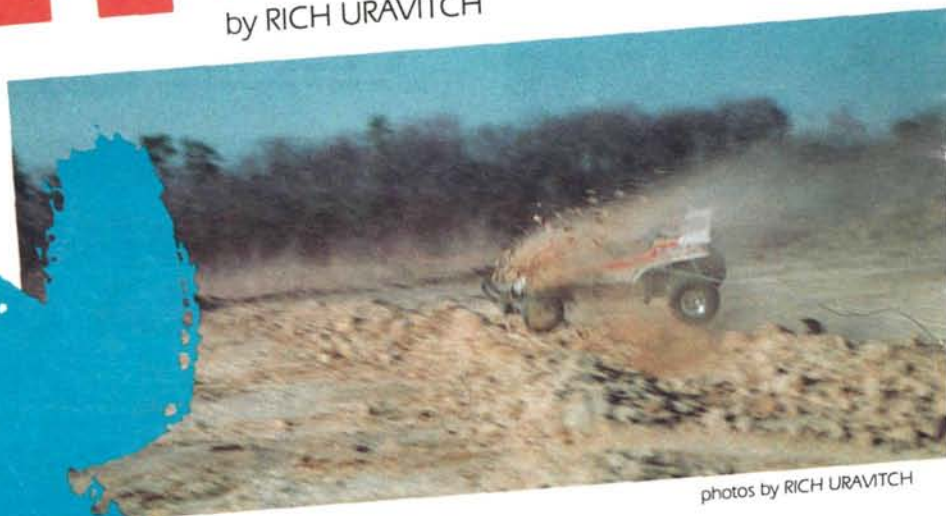


MRC-Tamiya



HORNET

by RICH URAVITCH



photos by RICH URAVITCH

UNLESS YOU LIVE in environs where the only form of communication is the smoke signal, you've probably recognized the meteoric rise in popularity of R/C cars. Now that some of the smoke I mentioned has cleared, it's much easier to make some observations concerning the overall scene.

Firstly, the hobby is *big*—real big and getting bigger. Secondly, like lots of other things that expand rapidly, there's some good stuff and some not so good stuff. Finally, there's enough out there so the newcomer doesn't need to spend a fortune getting into the hobby. Good entry-level, high-quality cars that are well designed and nearly bullet-proof are a great starting point which, if the racer desires, can serve as his "training wheels." From there he can step up to 4WD, gas, enduro, hill climbers, flat track racers, whatever!

Capturing what certainly has to be a major portion of the overall R/C car market are the folks at MRC* who import and distribute the Tamiya line of R/C cars from Japan, a line which presently numbers over two dozen machines.

This review is my impression of the Tamiya Hornet, one of the hottest-selling cars around. It embodies all of the desirable qualities of an off-road machine, such as simplicity, ease of assembly, and, most importantly, ruggedness.

The clean and well-engineered Hornet is the Number 1-selling R/C car in the world.



The simplicity aspect yields another important requirement—ease of maintenance and supportability. After all, you *would* prefer racing your car rather than working on it, wouldn't you? The spare parts pipeline made possible by MRC through its dealers assures that you're "out of the pits and onto the track" in short order.

THE KIT. Everything you need to build the car, including a special Allen wrench, grease, and even oil for the shocks, is contained in the kit. About all you'll need to provide are some common tools, such as pliers and screwdrivers. To operate the Hornet, you'll need a 2- (or more) channel car radio, plus a battery pack and charger for the car itself. (Not on an airplane channel, please!) My Hornet is guided by a conventional twin stick two-channel Techniplus radio by Acoms from Altech Marketing*. This is a great little unit and its compact transmitter size makes

(Continued on page 99)



The MRC Quick Charger combined with the Techniplus 2-channel radio is an economical yet high-performance combination.

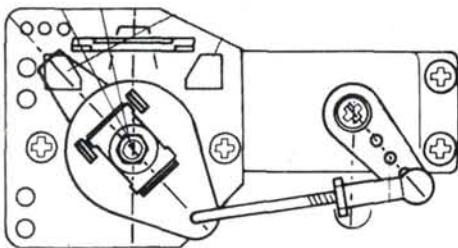
Troubleshooting

Car won't run? We just might have the solution!

by FRED MURPHY

IF I'VE HEARD IT ONCE, I've heard it a hundred times, "My car doesn't run." Keeping this in mind, let's talk about some basics of daily maintenance.

After a hard day at the track, all parts and areas around the chassis will be dirty and dusty. Look closely at moving parts and you'll find the areas where per-

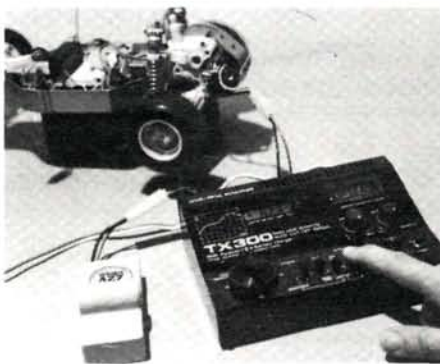


Your car's speed controller can be the source of running problems. Always make sure contact surfaces are clean.

formance is most vulnerable. But, before you look at performance, start with the heart of the car—its power source. If the power source isn't up to par in the radio system of the car, you've discovered the number one trouble spot. Never overlook the obvious! The rechargeable nickel-cadmium battery is the most widely recommended power source on the market today and if it isn't properly cared for it will take the enjoyment out of a great pastime. A 7.2V, 1,200 mAh battery in racing-pack or hump-pack form is able to push out more than 30 amperes, which is equivalent to 200 watts. Neglect of this high-performance power source can cause the electrical cords to overheat or melt and damage the battery or motor permanently.

Short circuiting is one of the most

damaging faults of nickel-cadmium batteries and occurs often. A short circuit will cause a large amount of electricity to flow in a short period of time, generating heat which can cause wires, or even the pack itself, to melt. A racing accident can cause extraordinary loads on your motor, having the same effect as a short circuit, resulting in damage to the battery, wiring, or the motor. After running your car, feel these components. If they are hot, stop running immediately and let them cool off before attempting to recharge your battery or run the car.



It's always wise to check the current draw of your motor. You should see a quick burst of power when the motor starts, then an amp or less of current as the motor spins.

Overcharging is also dangerous to your car's power source. Overcharging shortens the battery life rapidly, especially when you continually quick charge it. A charger with a 15-minute timer charges about 5 amperes of current into a nickel-cadmium battery during one cycle and causes nickel and cadmium to react chemically, producing gases at a rapid rate. If charging is continued beyond the



You must always check your power source, as the rechargeable pack is many times the culprit of problems. See text.

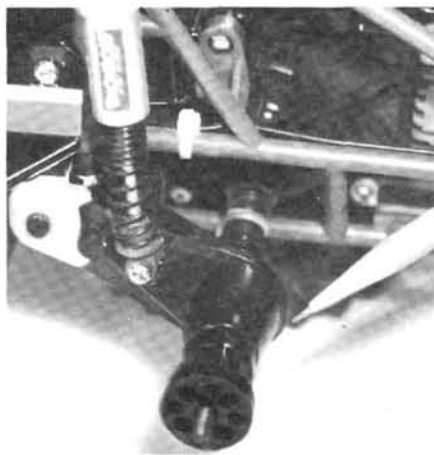
limit, the heat and gas generated will cause the wires or casing to melt. So overcharging should always be avoided. You don't have to worry about overcharging if you use a 14- to 16-hour charger.

If your car is equipped with a receiver battery box, be sure to check these batteries also. Many modelers overlook this area when they are having control problems with their cars. As a general rule, receiver power will be exhausted before transmitter power.

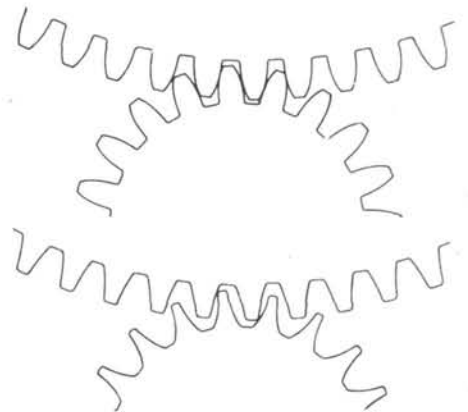
Daily maintenance is easy and essential for optimum performance. After running, brush away excess dirt and dust with a soft bristle paint brush (I use one that came with my son's water color paint set). Make sure that areas around your car's servos and speed control are clean and dry. Check for signs of rust on contact points of your speed control, and clean and relubricate if necessary. Besides



For smooth running and less resistance, always make sure axles are well-greased.



Also, don't forget the rear axles, where hubs come in contact with the axle. This will ensure friction-free operation.



Notice the difference between the good gear set on top, as opposed to the worn one on bottom. It is imperative to lubricate (3-In-1 oil will do fine) any meshing gears in your car and check for worn or broken teeth.

checking and cleaning structural and electrical components, make sure you have lubricated rotating parts; they'll play a key role in performance. Correct lubrication will not only give you a friction-free wheel rotation, but will allow smooth steering movement. Lubricate any meshing gears in your car and check for worn or broken teeth. A spray of 3-In-1 grade oil is good in these areas for

lubrication and for flushing away small particles of dirt and dust that can cause damage. Don't forget to grease the areas around the rear axles where wheel hubs come in contact with the axle. This will ensure effective transfer of power and friction-free operation.

Suspension is another area many modelers overlook. Keep springs and dampeners clean and well lubricated,

because if your tires don't rebound well and stay down on the track, the competition will leave you in the dust. Check oil levels in dampers and lubricate upright connect points to maintain that all-important friction-free movement.

Let these practices become habit and make the competition eat your dust. Good luck and happy motoring. ■

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Track Report

IN THE last few years auto manufacturers have given new life to the old factory performance wars.

The performance wars began in the early '60s and raged on until the gas crunch of the early '70s.

Back then you had your 427 Fairlanes and Boss 429 Mustangs from Ford, Chevelles and Corvettes with 454s from Chevy, and Barracudas sporting a 426 hemi from Mopar.

Now, with gas prices easing up a bit, factories have added fuel to the old fire. Now you have 302 Mustang GTs from Ford, IROC Z28s and Corvettes from Chevy, and Shelby Chargers and Lasers from Mopar. The whole appeal of the performance war is to buy the fastest production car of the time.

So now you have the fastest production car and you're ready to take on anyone who pulls up next to you. You're waiting at the light and, lo and behold, someone else also has the fastest production car and he's willing to pit his driving skill against yours. The light turns green and you put your right foot to the floor. You bury the gas pedal too fast, your tires begin to smoke, and your opponent smokes you.

A graphic with a dark red background. At the top, 'RC' is in large yellow block letters. Below it, '10' is in even larger yellow block letters. Overlaid on the '10' is the word 'Modified' in a white, cursive script. Below '10', the words 'From Associated Electrics' are written in a yellow, sans-serif font. At the bottom, 'by STEVE POND' is written in a smaller, white, sans-serif font.

With the agony of this embarrassing defeat fresh in your mind, you head for the local speed shop to pick up some high-performance goodies to ensure a victory the next time around. This is what's known as modifying.

Although it's on a much larger scale, what I've described here is not unique to the full-size automobile industry. The same holds true for the R/C car industry. When you consider buying an R/C car, the first thing on your mind is "Which one is the best?" Well, my friends, if you don't know yet, I'll

give you a very big hint. The RC10 from Associated Electrics* is the best. Although you may have an RC10, don't be sure you'll go home with the checkered flag every time. It is completely possible to be blown off the track by another RC10, and it is for this very reason that I'm doing this article on how to modify your RC10.

Before beginning the modifications, it's extremely important to adjust the suspension correctly. I'm sure that you've heard twenty different ways to go about this, but I'll lay these myths to rest. These

results are not from my testing, they are straight from Team Associated.

To begin adjusting the suspension, the car must be complete and the battery installed. Start with the spring clamps at the top of the shocks. Pick up the car about a foot off the workbench and drop it. When the car comes to rest, the rear A-arms should be parallel with the bench. If the car is sitting too low, move the spring clamps down $\frac{1}{8}$ inch at a time and drop the car again. Repeat this until the rear A-arms are parallel.

Now for the front suspension. Once again start with the spring clamps at the top of the shock. Pick up the car again and drop it. As you look at it from the side, the front end should sit just a hair higher than the rear. If not, adjust the shocks in the same manner as you did the rear. If you use a 7-cell battery, you'll have to readjust the suspension due to the added weight.

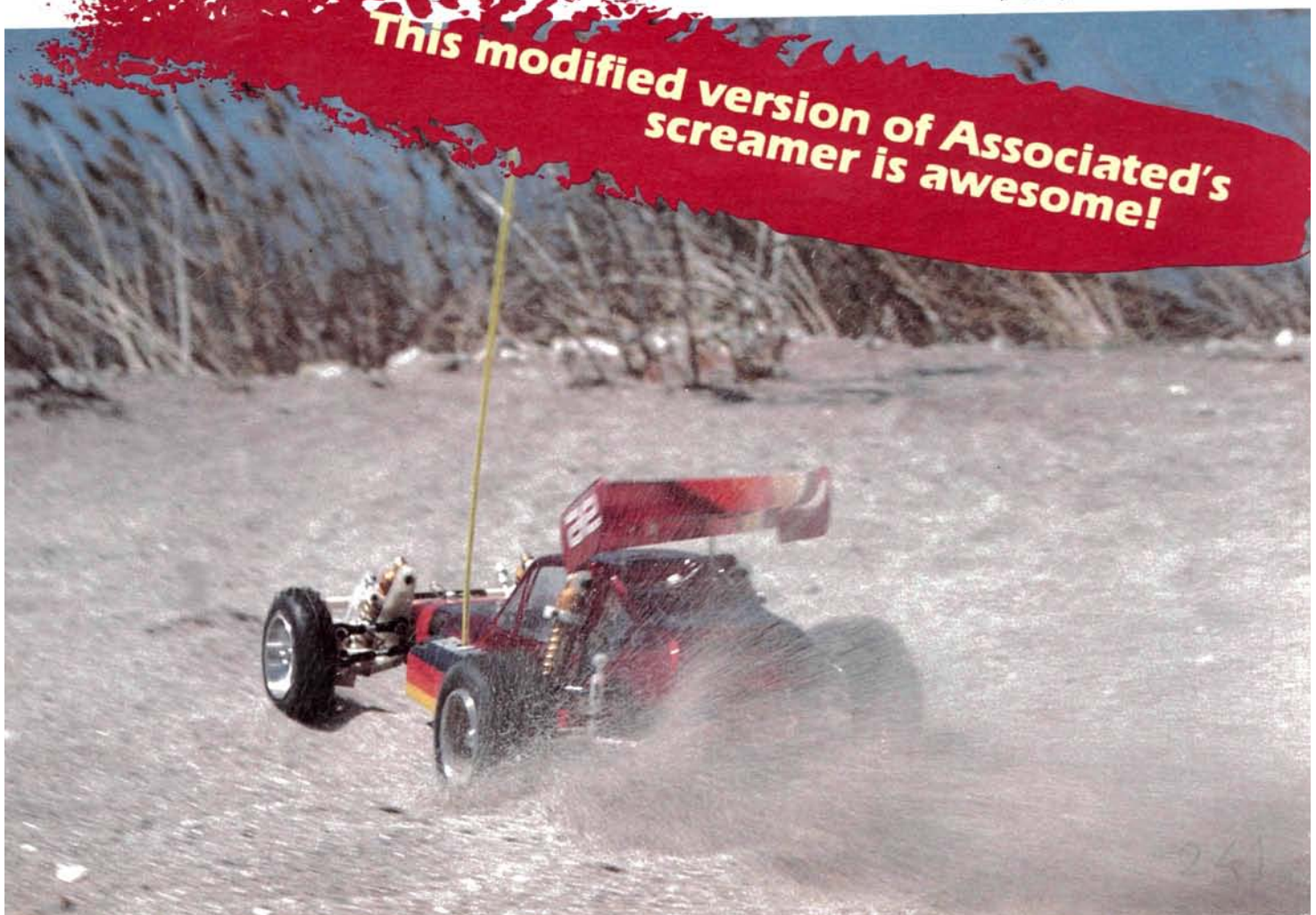
As far as the caster and camber are concerned, it's very simple. You want 0° caster and 0° camber. In other words, when you look at the car from the front, the wheels should be straight up and down (camber). And if

(Continued on page 64)



photos by Louis V. DeFrancesco Jr.

**This modified version of Associated's
screamer is awesome!**





photos by Cory Savage



R/C Pro STOCK

by CORY SAVAGE

An awesome 1/4-scale chainsaw engine-powered animal!

IF YOU'RE AT ALL familiar with drag racing, then you know one of the most popular classes of cars: the wild Detroit door-slammers known as Pro Stock. Take a 500-cubic inch engine that puts out approximately 1,500 horsepower, stuff it into a racing chassis, surround it with a fiberglass body, and you have one radical race car. What you see pictured is just that in a slightly

different dimension -- 1/4-scale.

If you saw the last issue of *R/C Car Action* (Spring '86), you've already seen my 1/4-scale funny cars and top-fuel dragster. This 1986 Ford Thunderbird is the latest addition to my racing stable. Just like its full-size relatives, this car is radically powered by a ground-pounding 3-horse chainsaw engine, mounted in an all-aluminum, slightly modified sprint car

chassis from Pacesetter Products*. The body is a fiberglass replica with all the aerodynamic tricks: lowered wheel openings, flush-mounted windows, and a full belly pan. Covered with ten coats of acrylic enamel and some very wild flames, hours of intricate masking and airbrushing went into this beauty.

Initial testing proves the car to be a little hairy to drive, but once the bugs are

worked out it will run in the 60-70 mph range, completely controlled with a two-channel radio.

Watch future issues for more of my drag racing cars, such as a nasty '32 Ford fuel altered and the most radical R/C race car ever built; an 82cc fuel-burning funny car.

**The following is the address of the company mentioned in this article:*

Pacesetter Products, P.O. Box 257, Mountain Center, CA 92361; 714-659-2318.

Track Repo



MARUI **BIG BEAR**

from Model Expo

**Move over ¹/₁₀ off-roaders!
Big Bear is here!**

by JACK SEID



FOR AS LONG AS I can remember, I've loved cars. Years ago I was involved with slot cars, so interest in R/C cars was natural for me. I decided to start anew with an off-road electric R/C car, but which one? There are literally dozens of different cars to choose from in whatever format you want: dune buggies, jeeps, mini pickups, two- or four-wheel drives, and even four-wheel steering vehicles! Fortunately, I live in an area where there are a lot of R/C hobby shops. I spent a little time at

Fortunately, I live in an area where there are a lot of R/C hobby shops. I spent a little time at

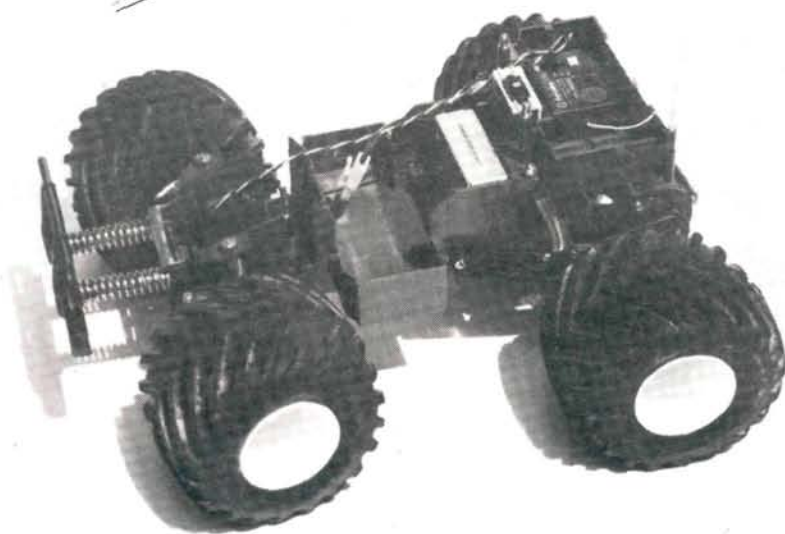
each one and asked a lot of questions. The result was my purchase of Marui's Big Bear Datsun pickup, distributed by Model Expo*.

I chose Big Bear for several reasons. I wanted an off-road car that I could also drive on the street, and with those big tires, Big Bear is the toughest-looking beast out there. It's also moderately priced. I decided to go with a pistol-grip radio and purchased the Futaba* Magnum Junior.

THE KIT. When I first opened the Big Bear box and examined the contents, I was a little intimidated, but Marui does an excellent job of packaging the pieces and required hardware for each subassembly.

All plastic parts are numbered, making the beautifully-illustrated instructions very easy to follow. A panel at the top of each page depicts the small pieces (full-scale) used for that step. Follow the kit assembly as shown in the instructions or you could encounter problems.

CONSTRUCTION. Assembly is very easy and begins with mounting the



Extremely durable one-piece chassis and very large semi-pneumatic tires make the Big Bear a formidable machine.

HEAVY ARTILLERY

independent front suspension to the chassis. Next is the rear differential, which has a bevel gear design similar to automobiles. There are four bevel gears; two mount within the differential gear, and the other two each mount on an axle shaft. Be careful to mount the two bevel gears with the extra shoulder on the back within

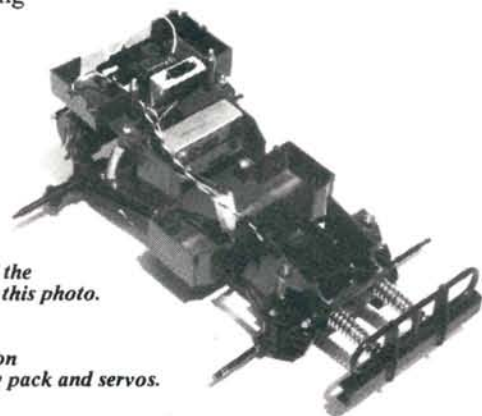
the differential gear and the other two onto the axle shafts. The black M480RS motor also mounts into the differential.

After mounting the rear differential to the chassis, mount the large semi-pneumatic tires onto the three-piece rims. Each of these is held together by four screws and is then installed onto its respective axle. Make sure while you're doing this that the "V"

(Continued on page 103)



Left: The true-scale looks of the Big Bear are evident in this photo.



Right: Note independent suspension and ample room for battery pack and servos.

RC 10 *Modified*

you look at it from the top, the front wheels should be parallel (caster). If you run on an oval track, give the outside front and rear wheels a little increased camber (tilt in). Now that we have that out of the way, we can begin with the modifications.

I'll start with the suspension. As far as the shocks are concerned, these are just about the best in the business so leave them right where they are. If you find your car bottoming out too often, you might want to go with 30- or 40-weight oil for the shocks.

Now the anti-roll bar. The RC10 comes equipped with a front anti-roll bar, but it is not adjustable. I chose to use the Parma* front and rear adjustable anti-roll bars and found that they improved cornering and straight line stability.

Next is the linkage. Parma manufacturers a kit to replace the stock steering linkage and upper control arms. This linkage is much more durable than the stock hardware and is easier to adjust. Parma also offers servo saver O-rings to take some of the play out of the servo saver or to hold a broken one together to get you through the day.

Now for some modifications on the electronics. The speed controller that comes with the RC10 is one of the most efficient in the business but it doesn't



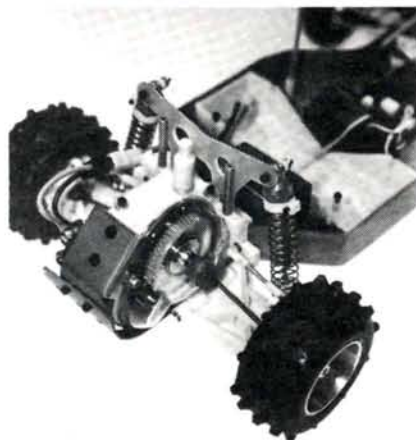
Top: Here's the RC10 with all the after-market goodies, sans body. **Bottom:** Pro-Tech charger from Model Craft was used. You can even charge from your car's cigarette lighter.



For rocket-ship performance, we of course chose the Reedy-modified motor from Associated.

have reverse. Some people say they don't need reverse, but I find a lot of use for it. If you share this feeling, Parma also offers an identical speed controller with the addition of a microswitch for reverse. If you would like to go one step further, Futaba* makes two different electronic speed controllers with more proportional speed control and reverse. The Futaba MC8 is the more economical version with a surge capacity of 30 amps. This is more than enough if you plan to run a

(Continued on page 84)



Left: Note Parma differential dust cover to prolong life of rear end. Also note CRP knobby tires. **Above:** Beautiful one-piece aluminum wheels were supplied by Advance Engineering.



What radio do you use with the ultimate car? The Futaba Magnum!

GRAND NATIONALS

The heat was on at this
1/12-scale championships!

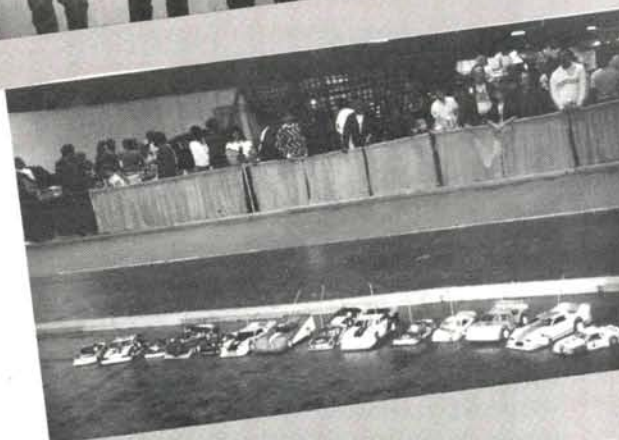
by MIKE LEE



Lineup at the start of the race! A pit man does the final line for his driver's car just before the start of a heat in 1/10-scale.



The victors in the Expert class. From left: Tim Copp, third; Rich Hohwart, second; winner Tony Neisinger; Mike Mayberry, fourth; and Larry Stevens, fifth.



A lineup of the cars contending for the concours awards. Some very good-looking paint jobs in both 1/10- and 1/12-scale.



Left: Concours winners and their winning cars. Jeff Deacon, left, with his 1/12 Thunderbird; and Linda Gupta, right, with her Buick Stock Car.

the first time that a major race featured the lightning-quick 1/12 cars and the ultra-tough 1/10 off-roadsters on an indoor carpeted oval track.

In this race, the rules were simple. Any 1/12 electric car with 6 cells and a modified motor was eligible. Bodies were limited to NASCAR-style stock car bodies with windows intact and scale-size spoilers. The races were standard 8-minute heats and mains.

For the 1/10-scale cars, major changes were needed. First, only smooth rubber or sponge tires were allowed on the carpeted track and bodies had to be either NASCAR- or ASA-type, with appropriate spoilers and dams. Open motors were allowed, along with 7-cell battery packs. Two classes were run; one

for two-wheel drive cars and one for four-wheel drive. Four-minute heats and mains were the rule.

An additional class was the BoLink Invader class, limited to the BoLink Invader chassis and the NASCAR or ASA body. As in the other 1/10 classes open motors and 7 cells were allowed.

The race was held at the National Orange Show fairgrounds in San Bernardino, in conjunction with a custom show by R.C. Cannings. It was great to be a part of the show and to see so many gorgeous custom cars. The first day of racing was Friday, March 14, with official practice held.

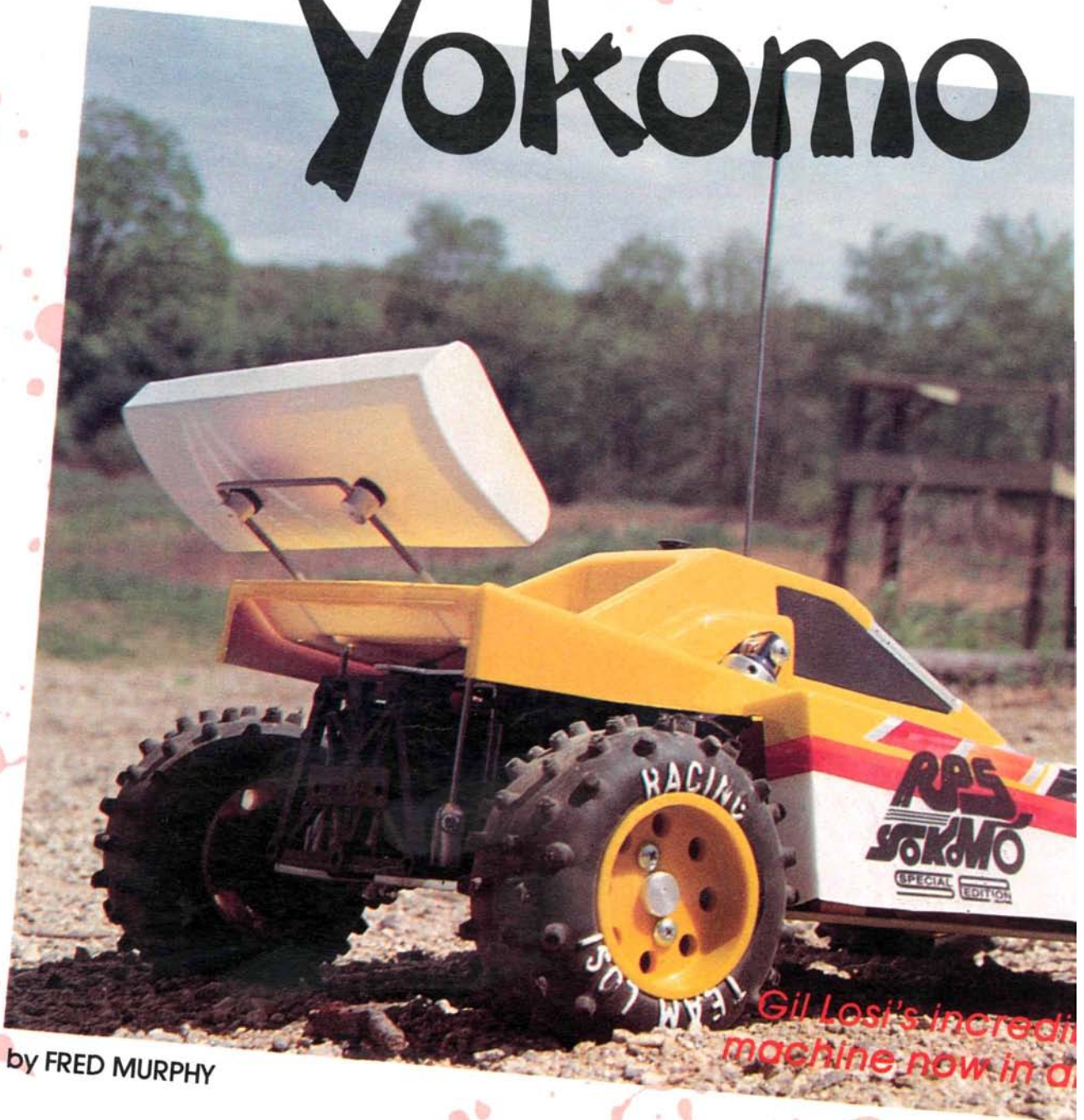
Let me tell you something about the kind of indoor racing. The track was constructed of standard green indoor outdoor carpet laid out in an oval: 85-feet long on the straights and 100-feet long through the turns. This made

(Continued on page 67)

IN THE WORLD of full-scale racing, one thought comes to mind when someone mentions Grand Nationals style racing—stock cars, the replica-bodied cars from the vehicles right off Main Street, USA. These are the cars traditionally seen on the high-banked oval tracks with Petty, Elliott, or Baker at the wheel. We all know the scene and most race enthusiasts love it.

In San Bernardino, California, the stock car scene came alive in the 1/12 and 1/10 R/C car divisions in the first annual Grand Nationals Championships. It was

Yokomo



by FRED MURPHY

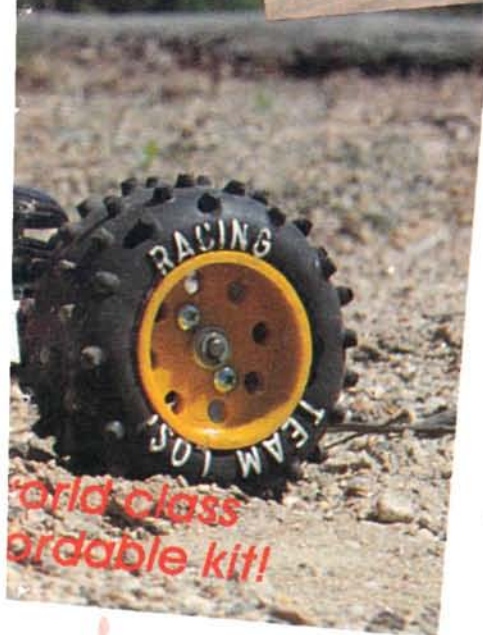
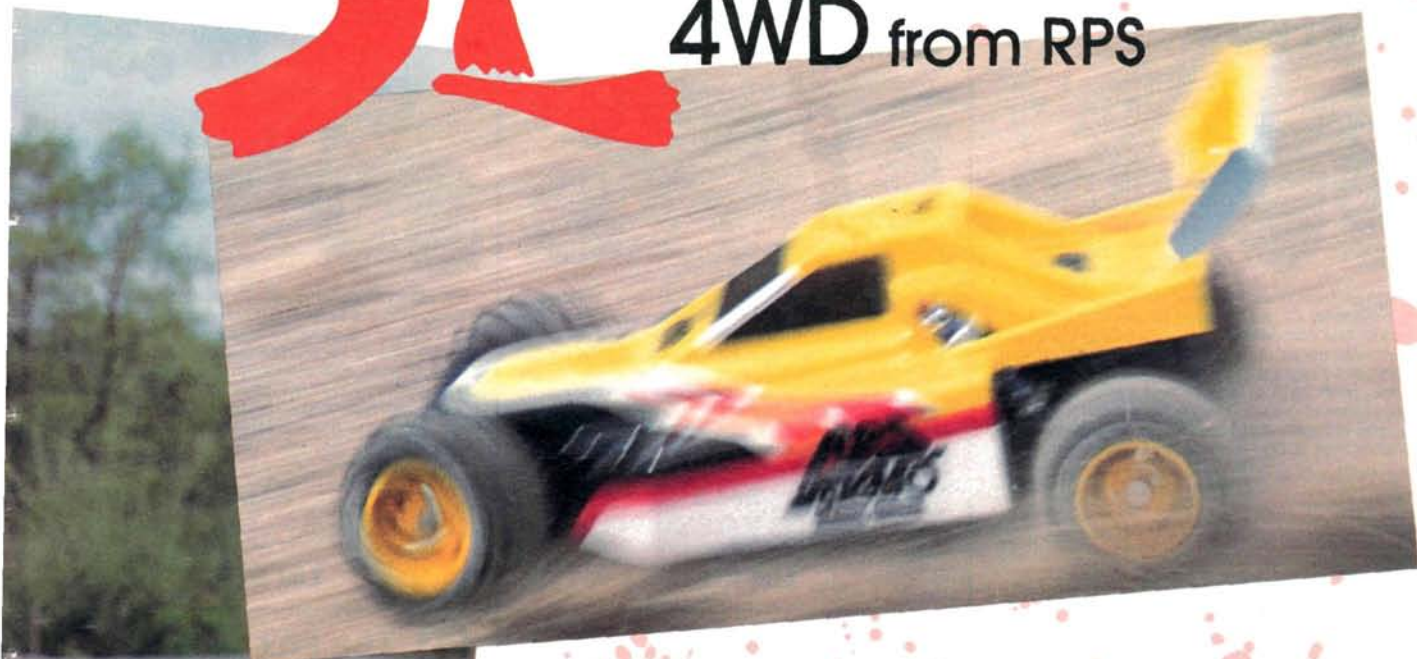
Gil Losi's incredible machine now in a

When the dust cleared at the Off-Road World Championships in Del Mar, California, it was no surprise that Gil Losi and his RPS Yokomo were in the winner's circle. Gil is unquestionably the premier off-road champ and has won just about every off-road race imaginable. The RPS Yokomo is his car and what an awesome machine it is! For this kind of performance you would think an investment of \$600 to \$800 would be necessary. Dream on. Now you can do it for just about \$200 with the new Yokomo SE.

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'SE'

4WD from RPS



World class
affordable kit!

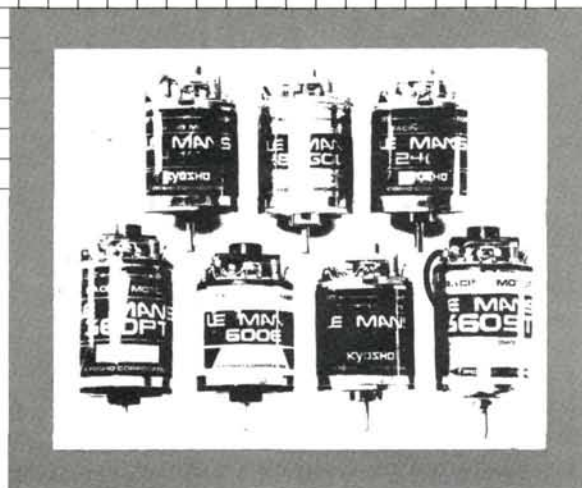
THE CREDITS OF the Yokomo speak for themselves, but this special edition model is by far in a class by itself. The RPS Yokomo SE 4WD, with many changes inspired by the I.F.M.A.R. unlimited champion driven by Gil Losi, Jr., is a car worth hundreds of dollars more than its selling price. The special edition includes a Yokomo .05 stock motor with a 14-tooth brass pinion, a new simplified slipper, new lower front suspension arms, a new front shock, new hardened front axles, a new 1-to-1 front-wheel-drive ratio, new steel shaft transmission gears, a new roll bar system, a new rear shock suspension, new heavy-duty rear trailing arms, a new lightweight fiberglass chassis along with Team Losi tires, and optional NMB ball bearings. When you combine all these championship features into one deluxe kit, you've got a proven winner.

The deluxe kit with NMB ball bearings went together easily in about 4½ hours and only needed minor steering adjustments once it got to the track. While I was doing the assembly it was obvious that this car's design was well-thought-out. The new suspension's flexibility allowed easy fine-tuning and unlimited performance. This suspension, and the Yokomo's low CG and 50/50 weight distribution, gave one of the finest rides I've ever experienced.

I ran the Yokomo on the local speed track and it fit the SE like a glove. With the new slipper, the car left the line with no spin and achieved top end quickly. Entering the first turn, I backed off the throttle a little, allowing the one-directional front bearing system to give complete steering control in setting up a good exit line as I got back on the throttle. As I approached the tabletop, I stayed on it and drew a bead on the backside 1-foot drop. The Yokomo came off the top like a bullet and sat back down on the track without flinching. At this point, I got back on the throttle and made a hard left, getting back on the gas quickly. With very little roll, the SE dug in and barreled down the stretch with great authority. After making two more quick

(Continued on page 113)

E^{lectric} M^{otors}



IN ANY sport that's popular today, there's a key item that created a spurt in the growth of that sport. Tennis grew with the introduction of the economical tennis racquet, the game of catch was revitalized with the Frisbee, and R/C cars surged in popularity due to the electric motor.

With the introduction of the small but very powerful Mabuchi 540 motor some years ago, R/C car racing was able to make the transition from the traditional gas-powered road cars to the very popular electric off-roadsters. Its advantages are outstanding: it requires little voltage, it has a high energy output, there's no residual exhaust products, and it has the ability to be ready at the flick of a switch. It created the fantastic expansion of R/C car racing that we're experiencing right now.

In order to get the most from these little powerhouses, you should know what makes them tick. The theory on how they work isn't as important as how

to maintain them. I'll take you for a detailed tour of the common electric motor so you'll know how to get the most from your investment.

The motor I'm using for this tour is the Le Mans 240 from Kyosho, courtesy of Great Planes Model Distributors*. This is a 4-minute motor for off-road use and has a ball bearing-supported armature.

The basic motor can be separated into several distinct components. Each component is nothing without the others, so you have a "one for all and all for one" assembly. Each component contributes something to make the whole motor work.

The components include the can or casing, the endbell, the armature and commutator, and the magnets. As you can see, it's not really all that complicated. The motor can is the first thing you see in any motor. It is the main casing into which all other components

by MIKE LEE

fit, and it's usually made of a ferrite-based metal, more for economics than effect. The motor itself is normally mounted by the can, and the can has cooling slots for ventilation.

The can's main function is to hold everything together and to house the magnets. The end bearing can be found at the end of the can and this bearing supports the armature shaft. The other end of this armature shaft is supported by the end bearing found in the endbell. Bearings are either bronze Oilites or ball bearings, depending on the make and model.

The other main function of the can is to prevent foreign matter from fouling the movement of the armature, and to act as a heat sink for the armature while it's in operation.

My example motor features a rolled

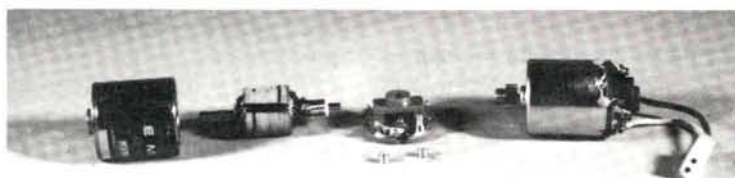
steel main can with a machined aluminum end plug. This was probably done to prevent magnetic foreign material from being attracted to the end plug and later on being sucked into the cooling vents. A ball bearing is press-fit into the end plug from the interior side of the plug and this prevents dust and dirt from working their way into the bearing and wearing it out. A generous amount of cooling vents are provided in the end plug.

The next component of the motor is the endbell. The endbell houses the second of two bearings, plus the armature contact brushes. On many modern motors, the endbell has the brush plates, wire contact lugs, brush springs, and mounting tabs or screws.

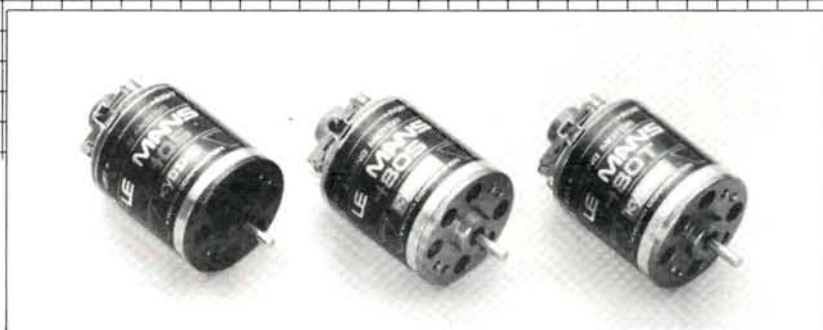
The main function of the endbell is to provide the electrical energy from the power source (the batteries) to the armature. Other functions include support of the armature itself, timing of the motor, and motor ventilation.

Delivering electricity to the armature involves several things. The process begins with power being provided from the battery to the power lugs. The lugs are electrically connected to the brushes, either by plates or by wire shunts, or both. For all practical purposes, the plates should not cause any electrical resistance in the flow of power to the brushes, hence the use of shunts in most racing motors.

Shunts are high-voltage, low- (if any) resistance braided wires connected from the power lugs directly to the brushes. They prevent any power loss due to electrical resistance.



Our electric motor disassembled into the basic components. From left, the can, the armature, and the endbell. On right is a fully assembled motor.



These Kyosho motors are the standard-type 05s used for R/C cars. We used the LeMans 240S on the left.

The brushes are the electrical contacts with the armature. Made of a graphite material, they are highly conductive and non-abrasive. Functionally, the brushes maintain physical contact with the armature commutator section in order to provide the flow of power to the armature poles. Loss of direct contact results in loss of electrical contact and the motor ceases to work. The brushes are also designed to prevent arcing, which results in the pitting of the commutator as well as brush disintegration.

The endbell also has a lot to do with the motor timing. Not unlike the timing of a full-size V-8 engine in automobiles, the timing of electric motors will dictate how fast or slow the armature will turn when running. And, again like the full-size engine, too much advance or retard of the timing can have serious effects on performance.

Most motors come from their manufacturers timed to provide the most efficient power delivery for a given application, without exposing the motor to hazardous side-effects, such as heat or arcing. I'm not going into the timing of the motor, as this is best left to the experts or stout at heart. Suffice it to say that the motor you purchase will perform at its best 99.9% of the time without your having to retune it.

The example motor has the capability of being easily retimed through twisting

of the endbell. Timing marks are provided on the can for reference, and there's also a reference arrow on the endbell. Timing advancement will provide higher rpm at the cost of less running time. Retarding the timing will slow the motor and lengthen the running time, but because this motor was designed to run 4 minutes, a couple of degrees of advance might put you in the lead of the race, but the motor might quit early when it drains all the battery power before the end of the race. By the same token, retarding the timing might make the motor last for you, but you defeat the design by doing so and you can get better performance by using a more appropriate motor.



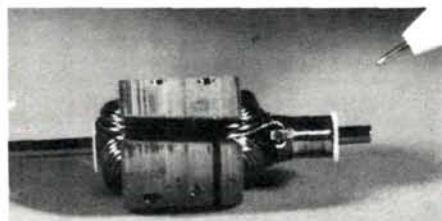
The motor can, showing the internal magnets and cooling vents. Also note inside is the main bearing to support the armature shaft.

Now we get to the very heart of the motor, the armature. This is what does all the electrical work by turning electrical energy into mechanical energy. The armature consists of two main elements: the poles and the commutator.

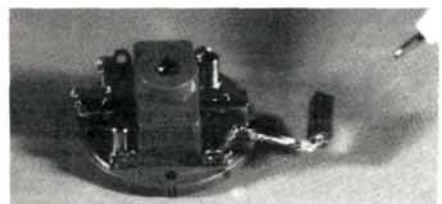
The poles are considered to be the portion of the armature that has copper wire wound around it. The armature of our motors features three separate poles, although motors for other uses can have dozens. The wire on the poles is of highly conductive copper. The poles themselves are ferrite-based, and when the wire is

charged with electrical energy, the poles become electromagnetic. The electromagnetic field created by the poles interacts with the natural ferrite magnets in the motor can. The electromagnet tends to oppose or push away from the natural magnets in a set direction. You now have movement of the armature. Here is where the commutator comes into play.

The commutator is the element that provides the power to the individual poles. By charging only one pole at a time, the armature will make a movement to resist the natural magnets. But



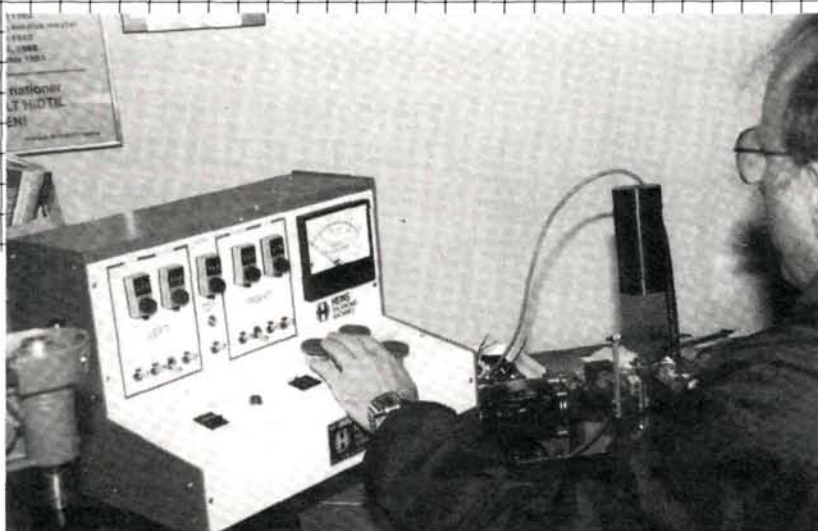
The heart of any motor, the armature. Pen points to the commutator portion where the timing is and where electrical contact is made.



The endbell portion of the motor, with pen pointing to the brushes. Endbell holds the second of the two main bearings and also has cooling vents.

he pole will only move so far before the incharged poles and the magnets hold the armature in magnetic balance. Just before this happens, the commutator provides energy to the next pole and cuts off the previous pole. The next pole makes its movement and the process continues. The faster the exchange of energy, the faster the armature moves.

A normal armature is moving anywhere from 10,000 rpm to a heart-topping 30,000 rpm. Luckily, electricity travels at the speed of light, making even higher speeds possible. But funny things



Mike Reedy using an ultra-modern armature-balancing system. This balancer performs dynamic balancing by computer tracking of the heavy spots. Very accurate and expensive.

can happen even at the lower end of our speed spectrum.

At a mere 10,000 rpm, the kinetic force on the wire wrapped around the pole is incredible. The normal result is that the armature throws a wind and the motor is destroyed, something like throwing a rod in a hot street car. To prevent this, most armatures are glued after being wound. This can be a simple dip in a lacquer-based solution or the use of hot epoxy. At any rate, gluing is a must for high-performance armatures.

To improve the performance of an armature you can also balance and true it. This is a process where the armature is first made perfectly straight and true while spinning, and is normally done on a lathe. The commutator can also receive this treatment. Competition motors are trued with diamond cutters. Truing the commutator prevents an out-of-round condition from robbing the armature of energy due to vibration.

Balancing the armature is a process which gives it a perfectly even weight distribution. This is performed by static means or dynamic means. A static balance means that the armature is balanced using its weight to determine the heavier areas, with no real spinning of the arma-

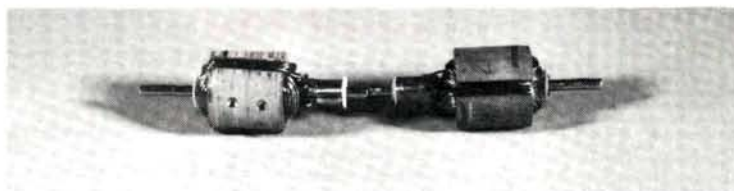
ture involved. Dynamic balancing determines heavy spots by spinning the armature and watching for the heavy spots to produce a wobble in the spin. This must be done using high-technology computers and it's expensive. Either method makes a marked improvement in the performance of the motor, sometimes doubling the performance, depending on the condition of the raw armature.

Now that you know of the motor components, how do you maintain the motor to keep it running in top form? Very easily, indeed.

We have found that foreign matter can foul the armature and slow it down. We also know that the brushes are in direct contact with the commutator and that means some type of wear. We have found that there can be electrical resistance from several sources, and that the magnetic forces at work have a great deal to do with the armature turning. Lastly, we know that timing can affect armature performance and balance. Let's now dwell on these facts to find out how to perform maintenance.

One of the most important things to do in maintenance is to keep the motor clean. Foreign debris, such as dirt, dust,

(Continued on page 100)



Comparison photo of a balanced armature on left, and an unbalanced armature on right. Note the balancing holes drilled into the balanced armature.



Battery Pack Construction and Care

by MIKE LEE

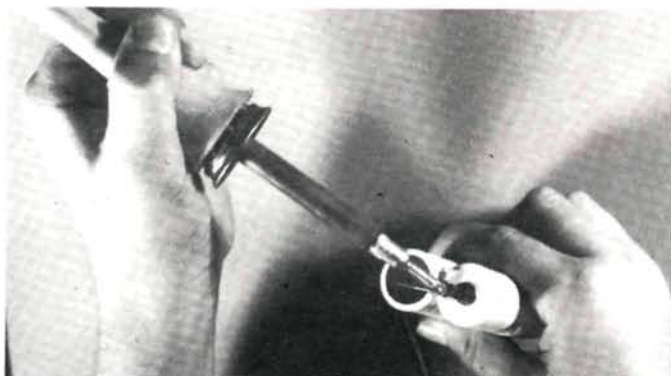
ONE OF THE SINGLE most important items that has spurred the growth of R/C cars is the rechargeable nickel-cadmium based battery. This small but powerful electrical storage source has not only added punch to electric R/C car motors, but is also responsible for making this sport so

for the electric motor. You'll need a couple of tools: a good 40-watt or better soldering iron, rosin core solder, sandpaper, tape, and heat-shrink tubing.

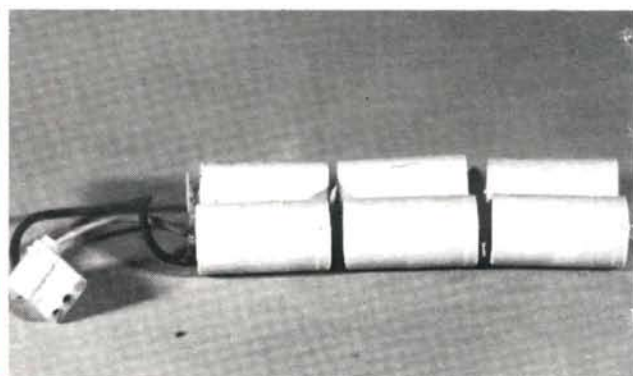
Your battery pack will be made up of six individual batteries wired together in series. A series-type connection means that all the batteries are aligned one

welded to each end of the battery for connection purposes. Use solder tabs for your connections.

Have your soldering iron and solder handy. The solder must be the rosin core type. Acid core solder is taboo because it will corrode any areas it touches and might eventually destroy the connection.



For soldering the pack together using the solder tabs, a high-powered soldering iron is a must. Make all solder joints on the solder tabs only to avoid excessive heat to the battery cells.



The soldered battery pack in a twin-stick configuration. Note that the cells are still loose, but ready to cover with heat-shrink material.

affordable. Imagine the cost of replacement batteries if you had to use non-rechargeable batteries just to run your car one more time!

In this article I want to discuss the basics of making your own battery pack and how to care for it. You might find that you'll not only save yourself a few dollars, but you'll also make that dollar investment stretch by keeping your batteries in shape.

There's no mystery in the making of a battery pack. For the purpose of this article, I'll concentrate on the standard 6-cell battery pack used to provide power

behind the other and connected in order to combine their power. When connected in series, the six cells combine their voltage values, providing a total voltage value of about 7.2 volts. Normally, each cell holds 1.2 volts. The amperage value of the individual cells doesn't combine when in series connection, and therefore the amperage value remains at 1,200 mAh.

In order to make the six separate cells into one pack, you have to solder them together. Most battery cells that we use can be purchased with solder tabs attached. A solder tab is a small lug tack-

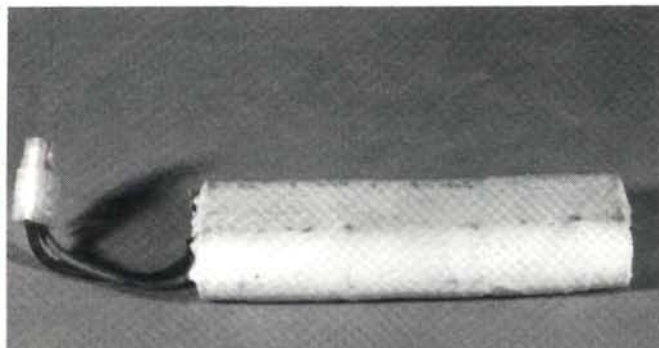
It will destroy electrical components. In addition to solder, you might also want to have solder flux handy, as this aids in making good solder connections.

With the soldering iron good and hot, align the battery cells so that each cell connects its positive pole (+) to the next cell's negative pole (-). All six cells will connect this way. The first and last cell will connect to the wire leadouts.

Take two batteries and hold them side by side. The solder tabs should be touching to make a connection. With the hot soldering iron, use solder to join the two cells together. Use only enough solder to



The battery pack ready to accept heat-shrink material. Note the pack has been prepared by taping the cells closely together.



The battery pack covered with heat-shrink tubing and ready to use. Note the battery connector is already soldered in place with high-temperature silicone wire.

make a good joint; an excessive amount will only make a big glob of nothing. The joint should only take a few seconds to make. Any longer than this and you'll subject the cells to excessive heat.

If the solder is reluctant to flow into a good joint, roughen the solder tab with sandpaper. This will also clean the surfaces. Using soldering flux will also be a great help.

Once the joint is made, bend the cells over the connection so that the two cells are one on top of the other. Continue this

process until all six cells are connected. At the joint between the third and fourth cells, it isn't necessary to bend one cell over the other.

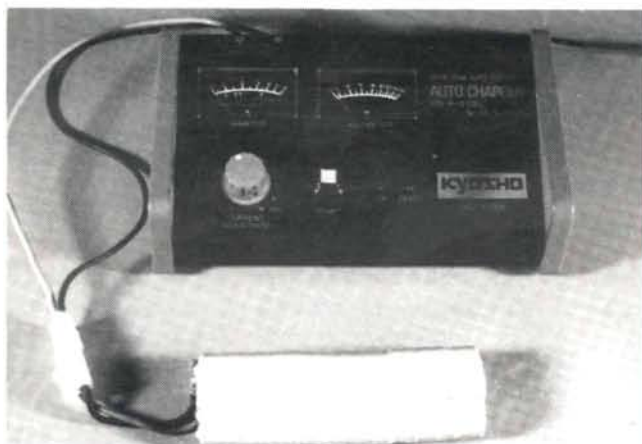
You should have all six cells connected, with positive poles connected to negative poles. Now tape the cells at the joints so that they'll maintain their alignment. Also tape the cells where they meet side to side. When you're done, you'll have a solid stick of battery cells.

For protection, use heat-shrink tubing over the entire pack. This is the fun part.

Cut a piece of tubing about 1 inch longer than the pack itself. Open the shrink tubing and slip the pack into it. Heat the tubing so it shrinks down to conform to the shape of the pack. A good heat source is a stove top. Use only enough heat to cause shrinkage, as excessive heat will melt the tubing.

Once the shrink tubing is on, solder your style of battery connector in place. For this connection, use a high-grade electrical wire. Always remember that

(Continued on page 104)



The battery pack hooked up to the Kyosho automatic battery charger, a peak-type charger. Metered face helps you monitor conditions while the charging process takes place.



Battery pack hooked up to the Leisure AC/DC charger. This charger is a constant-current type, which depends on the timer to suspend charging. A voltmeter attached to the wires helps detect the charging peak by monitoring voltage.

HOP UP YOUR RC10

(Continued from page 64)

stock motor in your car. If you plan on running a modified motor, the Futaba MC6B would be a better choice due to its 64-amp surge capacity.

The next thing to consider is the battery pack. If you use the original speed controller, it's better to stick with a 6-cell battery, because a 7-cell battery would cause a voltage increase. In the case of the RC10, the receiver is powered by the main battery and a 7-cell could be too much voltage for the receiver. On the other hand, if you use one of the electronic speed controls, anything goes. The electronic speed controls have a voltage regulator built in, so you can use any battery.

As far as the battery itself is concerned, I've found that the computer-matched Sanyo packs from Parma are a good choice. These packs are available in 6- or 7-cell.

Next is one of the most important ingredients to a modified R/C car, the motor, and Team Associated offers a full line of modified motors for your RC10. Although using a modified motor cuts running time, the increase in performance is well worth it.

The most important ingredient for your RC10, stock or modified, is the bearings. The use of bearings greatly reduces the rolling resistance of the car. This, in turn, gives you longer running time on your battery and a faster top speed, and they don't wear as fast as the bronze bushings. I think bearings are the

single most important improvement you can make on your RC10 if you don't already have them.

Next on the list are the pinion and spur gears. For starters, both the pinion and spur gears should be deburred prior to installation to allow for smoother running. If the gear combination that comes with the car just doesn't cut it on your track, don't sweat it. Team Associated offers spur gears from 44- to 54-tooth and pinion gears in the 11- to 16-tooth range. With a selection like this, you can tune your car to any type of track condition. Just remember when doing this or any other modification to do one step at a time. If you become impatient and start changing two or three things at once, you won't know what helped or hurt performance.

Last but not least are the cosmetic modifications. CRP makes a line of accessories for the RC10, such as bumpers, nerf wings, and antennas. The bumper not only protects the front of the chassis from scratches, it also protects the front wheels from collisions with other cars and other solid objects which could damage your steering linkage and servo. The nerf wing keeps an opponent's wheels from getting underneath your rear wheels, preventing an unexpected flip.

Parma also makes dust covers and bodies for the RC10. The dust cover resembles the original equipment, but it has a plug in the middle which can be removed to adjust the differential.

If you would like to change the rear wing, Thorp* makes a beautiful alum-

inum wing that can be adapted to the RC10 (see the RC10 review in the Winter '86 issue). The larger wing, originally designed for 1/8-scale cars, gives the RC10 good stability in flight and can be adapted with a wire bender.

As far as the wheels are concerned, a company called Advance Engineering* has just come out with the most beautiful aluminum one-piece wheels I've ever seen. Advance has designed wheels for this and many other R/C cars with many different patterns. The wheels are perfectly round, very lightweight, and extremely durable.

Keep in mind that there's no concrete list of modifications to do to your RC10. What might help you on one track could hurt on another. Take it slowly and do one modification at a time. After each modification, take the car to the track and time yourself for about five laps. If your times get better, you know you're on the "right track."

So the next time someone who also has one of the fastest production cars pulls up next to you, they're in for a big surprise!

*The following are the addresses of the companies mentioned in this article:

Associated Electrics, 1928 E. Edinger, r, Santa Ana, CA 92705.

Parma International, Inc., 13927 Progress Pkwy., N. Royalton, OH 44133.

Futaba Corporation of America, 555 West Victoria St., Compton, CA 90220.

Thorp Mfg., 380 S. East End, Unit H, Pomona, CA 91766.

Advance Eng. & Mfg. Co., 180 S. Highway 67, Unit G, P.O. Box 766, Woodland Park, CO 80866.

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H andling

by DICK BRINTON

There you are, running one of your best races yet, but every time you come to that series of closely spaced bumps, the "whoop de do's," your car goes upside-down and you lose another place or two.

You've got a good clean motor that puts out lots of power, but every time you get on it hard in the beginning of the long straight, the car goes bananas and you can't keep it moving in a straight line, so you have to back out of the throttle and...you lose another place.

It seems everyone else can rocket around this turn, but you keep spinning out, so you change tires to the kind the hotdogs are running and now your car rolls over in the turn, and going down the straightaway it's worse than it ever was before.

IF YOUR car suffers from any or all of the above maladies, you've got the handling blues. But cheer up, with a little bit of work, you can really improve your car's handling. Before I get into the ways to fix bad handling, here are some definitions:

Oversteer. (NASCAR and USAC guys call this "loose.") This is the tendency of a car, when traveling through a turn at high speed, to spin out when the rear tires lose traction before the front tires do.

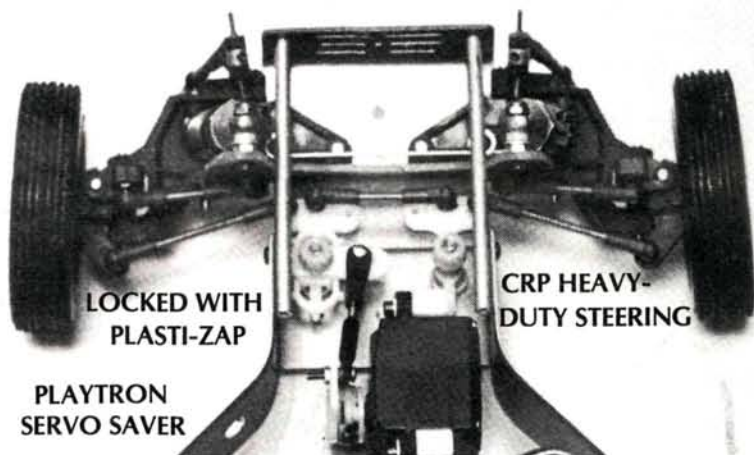
Understeer. (NASCAR and USAC guys call this "push.") This is the tendency of a car, when traveling through a turn at high speed, to run wider than the actual steering angle of the front tires when the front tires lose traction before the rear tires do.

In addition, you're faced with the problem of setting up your car so that it can handle the bumps and jumps built into the track.

On any off-road car, most of the following items can be changed. I'll list and define them, and then show you how changing them can improve the handling of your car.

Shock Absorber Damping Rate. This is the resistance the shock absorber offers to sudden movements of the suspension. You can stiffen or soften the shock dampening action by changing the weight of oil used in the shock absorber.

(Continued on page 88)



The wheel toe-in in this photo is excessive to illustrate the point. Note ball joint steering setup.

CASTER ANGLE



This photo illustrates the caster angle. Note vertical white line for reference.

Spring Rate. This is a measure of the stiffness of the spring.

Suspension Travel. This tells you how far the suspension can move in order to absorb bumps.

Toe-In/Out. This is the variation from parallel of the tires inward or outward when viewed from directly above. See diagram. Usually the rear wheel toe-in is factory set so you only have to be concerned with the front wheel toe-in/out.

Camber. This is the tilt in or out of the wheel when viewed end-on from the ground level. See diagram.

Caster. This is the angle of the steering axis when viewed from the side of the car. See diagram.

Tires. Those black round things on your wheels. Seriously, tires are one of the most effective changes you can make,



The excessive camber in this photo is used to illustrate the point.

but they don't always improve the problem.

Roll Stiffness. The resistance to rolling when in a turn is called roll stiffness. This also accounts for the transfer of forces across the car when the wheels on just one side of the car encounter a bump. The roll stiffness is usually adjusted by anti-roll or stabilizer bars at each end of the chassis.

The Wing. An aerodynamic device that can help or hurt handling.

Unsprung Weight. As far as we are concerned, this is the weight of the wheels and tires, and the effect of this weight on the suspension action.

Suspension Slop. This is unwanted movement of the suspension or steering

systems. It can come from wheel bearings that are worn out, a poorly set-up steering servo control connection, or anything in between that's loose.

Before you do anything to correct handling problems, you must remove all the suspension slop that you possibly can. Start by replacing all suspension members that have worn to the point where they produce a sloppy fit. If your wheel bearings are worn, now is the time to get a new set.

The most difficult area of slop to correct is the servo steering assembly and one of the worst offenders here is the Z-bend. If you must use a Z-bend, try tightening the action with a collar as shown. This will remove a lot of slop. I use ball joint connectors. I've also removed the factory servo savers on my Associated RC10 and now use only one on the servo.

Remember, if the wheels won't track accurately, it's very difficult to correct suspension faults and please don't forget that there are two ends to the car. You need to check the rear suspension as well.

Now concentrate on the suspension travel, shock damping, and spring rates since these all work together to control wheel movement.

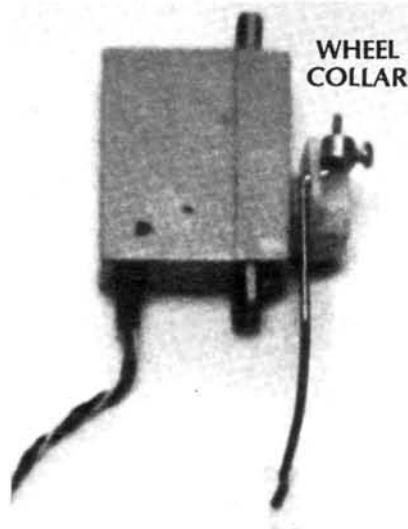
Suspension Travel. On any off-road racer, more suspension travel is always better. In the middle 1960s, the CZ 360

was the world champion motocross motorcycle. Mine had 6 inches of travel up front and 5.5 inches in the rear. Now you can't even get into the stadium without 12 inches of travel at both ends of the bike and some of the newer motorcycles have 14 inches of travel in their suspensions.

The very first step is to make sure your car is getting all of the suspension travel that the manufacturer designed into it. To accomplish this, remove the shock/spring units from the car. Move the suspension to the extremes of its travel and note how far it moves. Make sure it's not binding at any point.

Empty the oil from your shocks and use a cotton swab to clean out the barrel of the shock. While you're at it, clean the dirt and oil from the outside of the unit and also from the spring. Reassemble the unit without the oil and work it into your hand. Does it work freely without hanging up anywhere? If not, fix it before proceeding further.

Following the manufacturer's directions (do read them), refill the shock with

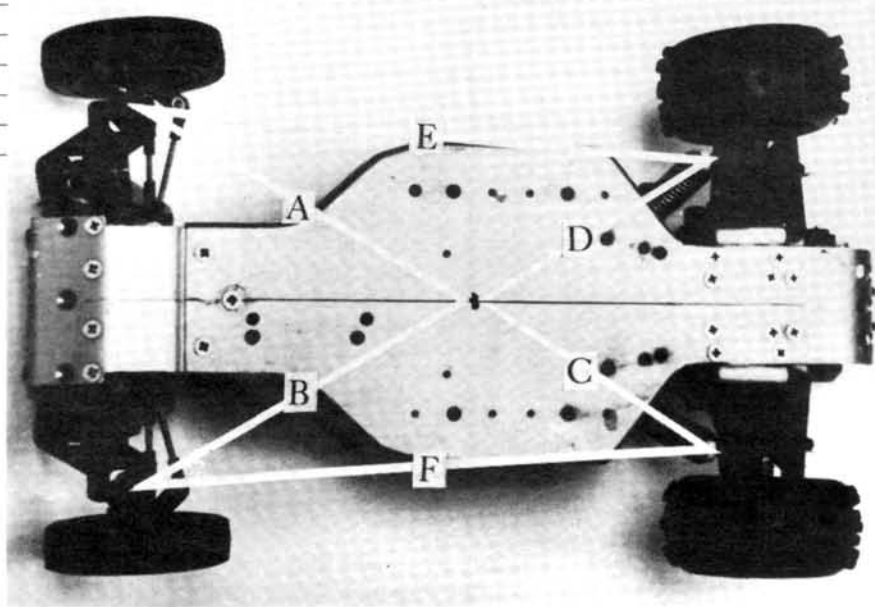


The wheel collar here is used to remove slop from the Z-bend.

the recommended oil. Try the action again. Does it still travel to its fullest limits? If not, you might have a hydraulic lock caused by too much oil or by the piston being in the wrong position when you filled the shock. You might also have introduced air bubbles into the shock, which will distort the shock action. Avoid air bubbles.

If the shock/spring unit is assembled correctly, but moves as if there were no oil in the shock, try using a heavier weight oil. Your shock might be wearing out and it might have developed too much clearance around the piston. Don't forget that temperature affects the viscosity of oil; oil that works fine in the winter will be too thin for summer use and vice versa. Normally it's best to err on the side of using oil that is a bit too thin in viscosity than oil that is too thick.

In my drag-racing days we used to say,



This method is used to check if the car is square. See text.

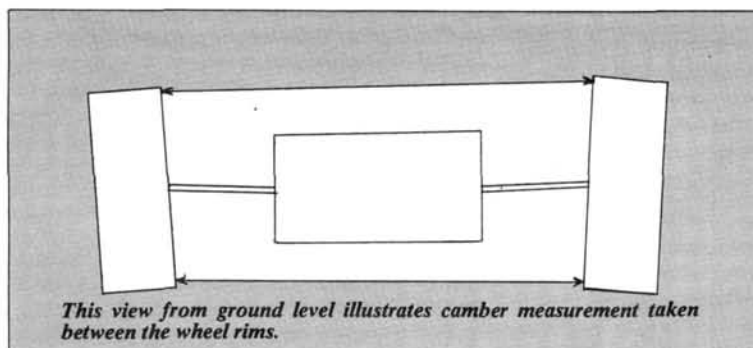
but becomes solid. When this happens, the suspension ceases to function and road shocks are transmitted directly to the chassis. In short, the car goes bananas!

If you have hop-up suspension parts or non-stock spring/shock units, make

sure they are the correct ones for your car. Don't use parts that reduce the normal suspension travel. They might look great, but they will really mess up your suspension action.

Now check and see that the car is "square." Scribe a mark on the bottom of the chassis exactly halfway between the rear suspension pivot points. Now scribe a mark halfway between the front suspension points. Draw a line down the centerline of your car that connects these points. Pick a point at the center of this line and mark it. Measure A, B, C, D, E, and F. A should equal B, C should equal D, and E should equal F. If these measurements are not equal, your car isn't going to track true and it will

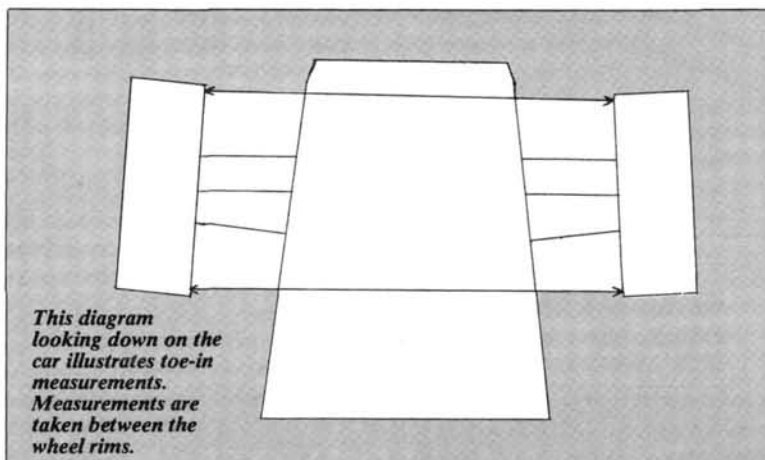
(Continued on page 106)



This view from ground level illustrates camber measurement taken between the wheel rims.

"If some is enough, more is just right, and too much is perfect." This isn't true when you're working on suspension systems.

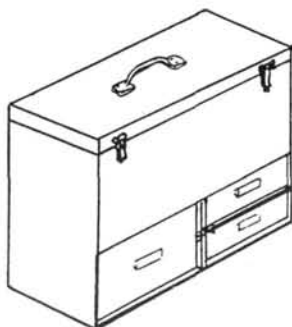
Now reinstall the shock/spring unit and move the suspension from limit to limit. Does it still move as far as it did without the shock/spring unit in place? It should! If it doesn't, find out why. Perhaps something is bent or the spring adjustment collar is too tight and is causing spring bind. This occurs when the spring is compressed so far that the individual coils come together and the spring no longer functions as a spring,



This diagram looking down on the car illustrates toe-in measurements. Measurements are taken between the wheel rims.

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GRAND NATIONALS

(Continued from page 66)

really interesting, as the straightaway speeds were great, but the turns were real buggers. The carpet provided extremely high traction, and running anything but hard tires produced spectacular traction rolls when a car negotiated the turns. My car had the steering to bare minimum throw, with tape added to the front right tire to keep it from grabbing through the turns. It wasn't unusual to see cars tumbling end-over-end when the tire bit down and rolled the car off the track.

On the other hand, the inside of the track had no carpet, and that left a painted concrete floor that put cars into skids which lasted the length of the straights. I have to admit, it looks very realistic to see a mini stock car skidding sideways out of control through the infield. The outside of the track had a pine board barrier to retain the cars should one go wide. It punished more than its share of stock cars during this race.

Saturday morning saw the opening rounds of qualifying. The 1/12 class was

broken down into three categories: Novice, Amateur, and Expert. Four qualifying heats were run to place the cars into their mains and that was plenty of time to get them dialed in. As a somewhat experienced off-road driver, I figured this oval-type racing would be a cinch. After almost destroying my car several times, I guessed I had figured wrong. The result was that I didn't get a clean run until the last qualifying heat and, by then, my once beautiful Thunderbird body was about ready to scrap.

As it turned out, Kirby Criger got the top qualifying time in Novice, with about 63 laps in the 8-minute heat. That figures to a lap every 7.6 seconds; not bad. In the Amateur class, Kenny Koch took TQ, and Rick Hohwart did it in the Expert class. Rick was cutting laps averaging 7 seconds, with some fast laps getting down to 6.5 seconds.

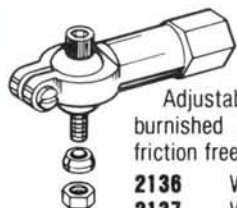
In the 1/10 two-wheel drive class, Marty Desbrow was top qualifier. Tony Rossetti was the fast man in four-wheel drive, and Frank Killam TQed in the BoLink Invader class.

Sunday morning saw the last of the

(Continued on page 98)

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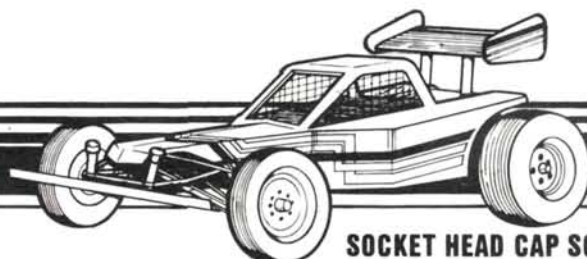
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What's New



MINI-MAGS

Mini-Mags by Advance Engineering & Manufacturing Co. (180 S. Highway 67, Unit G, P.O. Box 766, Woodland Park, CO 80866) are beautiful, one-piece, aircraft-quality, aluminum wheels for 1/12-, 1/10-, 1/8-, and 1/4-scale on- and off-road R/C cars.



REVERSE SWITCH ASSEMBLY

Add reverse capability to your RC10 with this assembly from Tammie's Hobbies (3625 S.W. Hall Blvd., Beaverton, OR 97005). It's easy to install and provides fantastic results.

THE ERTL COMPANY (Highways 136 and 20, Dyersville, IA 52040) introduces three new full-function vehicles that each have a total of nine functions including forward, reverse, forward right, forward left, reverse right, reverse left, stop, digital proportional steering, and digital proportional speed.



The new Blue Knight is a full-function Land Cruiser.



The Super Buggy has all nine functions with Super Spring Action.



The Monster Man Pickup includes all functions except digital proportional speed.



THE KYOSHO ICARUS is designed for entry-level modelers and is competitive against other "beginner" cars. The Icarus uses the LeMans 360ST electric motor, which produces 20,000-22,000 rpm and generates lots of torque. The 1/10 Icarus is 15.2 inches long and weighs 54 ounces. It requires a 6-cell battery pack, charger, and a two-channel radio. Icarus is distributed by Great Planes Model Distributors Co. (P.O. Box 4021, Champaign, IL 61820). For more info see the "Track Report" by Chris Chianelli elsewhere in this issue.



NIKKO AMERICA RHINO

The Rhino is a tough, thick-skinned beast just like its namesake. New from Nikko America (851 International Pkwy., Richardson, TX 75081), the Rhino includes a two-channel superheterodyne digital proportional system, thermostat protection for speed control resistor, a trailing arm front suspension, a rigid axle rear suspension, and removable cowling in red or white. The Rhino is 1/10-scale, measures 15½x9¼x6 inches, and weighs 21 ounces.



MRP 1/10 OFF-ROAD BODIES

The 1/10-scale Outlaw Wedge Super Stock and the 1/8-scale NASCAR Pontiac 2+2 are just two of the new Lexan bodies offered by Model Racing Products (18676 142nd Ave. N.E., Woodinville, WA 98072). Write for more info.



RACO MODEL CRAFT'S newest and most exciting addition in 1/4-scale cars is the Road Runner. Designed for road racing, it displays the same qualities and uses the same parts as the off-road Jac-Rabbit.

The Road Runner is styled after the radical open-wheel pavement supermodifieds so popular in NASCAR. The kit comes with engine, heavy-duty servos, and requires one hour to assemble. Two-channel radio, batteries, and charger not included. For more info contact your local hobby dealer or Raco Modelcraft (1421 E. Saint Andrews Pl., Santa Ana, CA 92705).



HOBBY BOXES

Here's a great way to keep your R/C cars and accessories organized. Boxes Plus (P.O. Box 176, Canby, OR 97013) has added this handy box, which measures 22x10 1/2 x 14 inches, to their line of products. It will hold two cars, two radios, and lots of accessories and is constructed of sturdy plywood. This box comes fully assembled and has a lockable top compartment and three drawers. Send an SASE for a free catalog.



TAMIYA PAINT MARKERS

Get professional results with Tamiya's Paint Markers. Available in 12 colors, these paint markers are

the easiest, safest, and surest way to get a great paint job on all surfaces, but especially those hard-to-detail small areas. Each marker contains the highest quality enamel paint in a quantity to cover 12 to 15 1/24-scale cars. These markers are compatible with acrylics and lacquers so they can be used for lettering and striping. Tamiya Paint Markers are distributed by Model Rectifier Corporation (2500 Woodbridge Ave., Edison, NJ 08817).

NEW PRODUCTS FROM CRP



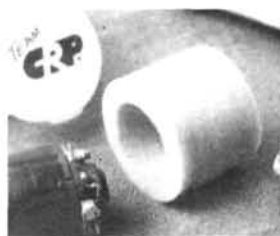
Team CRP Decals (#9111) add that extra touch of prestige to your car. There are four different sizes on one sheet. Available in black only.



The Dynamite Combination Front Tire (#4220) has a new combination tread pattern for when a spiked tread is too much traction and a smooth tread isn't enough. Fits 1 1/2-inch diameter front rims of the Frog, Hornet, Grasshopper, and Super Champ.



The Dynamite On-Road Rear Tire (#4221) is wide grooved and made of soft rubber to allow running your 1/10 off-road car on asphalt. Fits 1 1/2-inch diameter rear rims of the Frog, Hornet, Grasshopper, and Super Champ.



This Foam Endbell Cover (#2158) allows your motor to breathe unlike plastic covers. Fits all .05 electric motors with or without modular endbells.

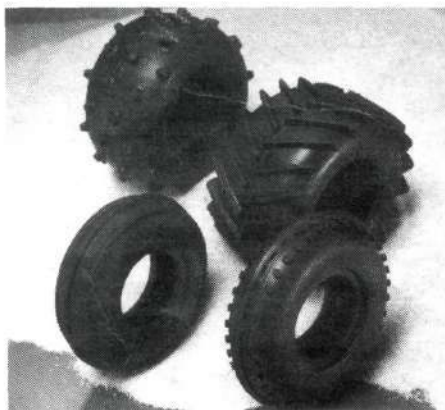


The Motor Tube (#2157) protects any .05 electric motor, with or without connectors, from dirt and other foreign objects while in your tool box.

What's New

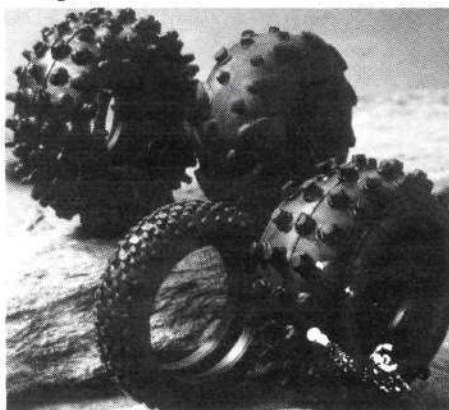
NEW FROM PRO LINE

Sand



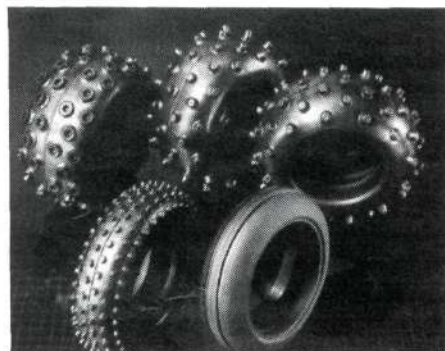
The Sand Series features treads designed to eliminate sinkage in sand and soft dirt.

Off-Road



The Off-Road Series has unique treads that are adaptable and durable on all off-road terrain.

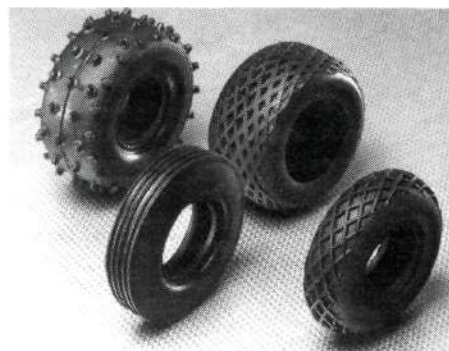
Challenger



The Challenger Series is specially engineered to give you a competitive edge.

Pro Line's (P.O. Box 456, Beaumont, CA 92223) new lineup has something for everyone.

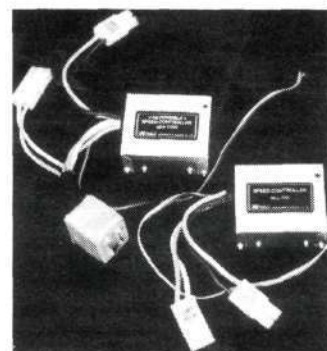
Fast-Track



The Fast Track Series has treads developed to improve performance on tight corners and high speeds.

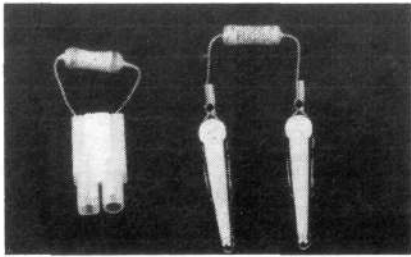


THE ACOMS TECHNISPORT AW-75R is a refined, easy-to-use wheel/pistol-grip radio available from Altech Marketing (P.O. Box 286, Fords, NJ 08863). It features servo reversing, mandatory ratchet trims, a steering dual rate thumbwheel, servo end travel adjustment, and a grip reverse for left-handers.



CIRCUS HOBBIES (3132 S. Highland Dr., Las Vegas, NV 89109) has added two new JR models to their line of speed controllers and other R/C car accessories. The JRA-700 is equipped with brakes only, making it an extremely race-worthy speed controller. The JRA-700B has a full reverse relay, making it ideal for buggies, off-road cars, and certain types of race cars. Both models are comparable to speed controllers costing twice as much and can be used with 7-cell battery packs.

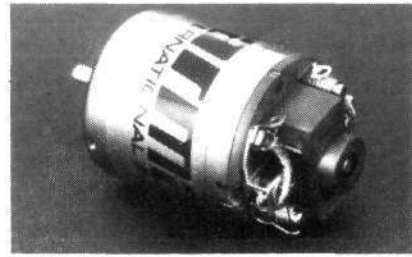
NEW PRODUCTS FROM PARMA



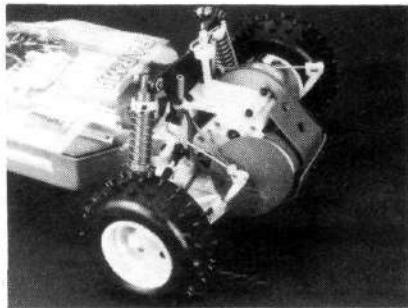
Battery Discharge Resistors. Discharging your batteries before recharging them greatly extends their life. #11201 is for packs with female Tamiya connectors and #11202 has alligator clips for use on all types of battery packs.



For those who prefer sedan type off-road cars, Parma's latest: a 1/10-scale 1965 Mustang (#10225). It comes with pictures of the original car for concourse detailing. Available in clear Lexan.



The Kyosho Stock Motor (#10816) is an ORRCA and ROAR approved stock motor—28 turns of 22 gauge.



The Cool Filter Endbell Dust Cover (#11011) keeps the dust and dirt off the commutator of the motor but still allows it to breathe.



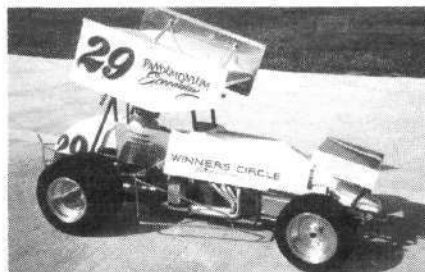
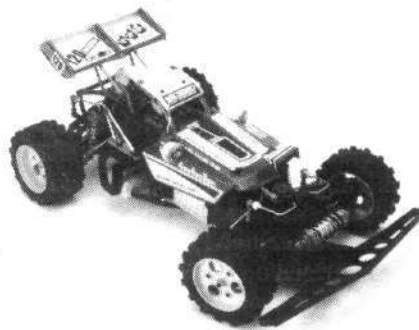
For 1/8-scale oval racing, nothing beats the 1/8-scale Parma ASA Camaro-Firebird (#1242). Available in clear Lexan.

These and other products are available from Parma International (13927 Progress Pkwy., N. Royalton, OH 44133).



MPE TECHNOLOGIES (P.O. Box 280, Wilsonville, OR 97070) announces the development of two new battery packs designed exclusively for 4x4 R/C trucks. The RoughRider rechargeable Nickel-Cadmium and the Force-5 rechargeable sealed Lead-Acid represent the latest in top-of-the-line manufacturing techniques. Matched cells and quality control checks right on down the line assure top performance and reliability in all battery products.

TRI-STAR IMPORTS, INC. (P.O. Box 11392, Santa Rosa, CA 95401) has imported the Exceed Pro 443 from the Nichimo Plastic Model Company of Tokyo, Japan. This 1/10 off-road car features four-wheel independent suspension, four-wheel drive/steering, three differentials, a polycarbonate body and wing, and a Mabuchi RS-540S motor.



WINNER'S CIRCLE MFG., now WCM (Rt. 2, Box 207A, Buffalo, TX 75831), has a new kit based on their very popular 1/4-scale sprint car scaled from the full-size Gambler Sprint Car run in the World of Outlaw and other sprint car circuits. The car measures 39x18x21 inches and weighs about 20 pounds race-ready. The kit comes complete with every nut, bolt, and part you need to race the car.

(Continued on page 112)

GRAND NATIONALS

(Continued from page 90)

qualifying heats. The large number of racers, some 80 to 85 drivers in all, kept race director Frank Killam working midnight shifts. Scores were kept with an Atari 800 computer system using manual lap count inputs. Although lap times were only as accurate as the man making the lap count, the computer definitely helped.

Seven cars lined up for the Novice B main, with yours truly behind one of them. From the very start, Barbie Smith took command of the field. Although her car was not the fastest, it handled the turns superbly and she used this to her advantage. Billy Sims stayed with her and even passed her a couple of times, only to find himself in the wall or in heavy traffic long enough for Barbie to pass. Glenn Higdon stayed within striking distance in third, and numb thumbs kept letting this strange yellow car pass him because he thought she was going faster. Turns out this dummy had gobs of speed and was letting the leader by him when he could have caught her. I'll

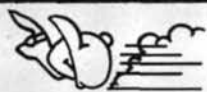
try harder next time around. Barbie continued on to win with Sims in second and Higdon third.

The Novice A main seven-car heat was a great race for the lead TQ man Kirby Criger, who was fresh from a trophy dash win and leaped out ahead of the pack. Wayne Breault and Fred Sachs held in close, with lead swapping every other lap. About halfway through the race, Sachs settled down into some steady racing and managed to pull away, leading the rest of the race for the win. It wasn't, however, without some sweat. Sachs started dumping batteries about the 7:15 mark and that let Breault catch up fast. In the last 10 seconds, Breault caught Sachs, but traction-rolled it in turn three and Sachs trundled by to get first place. Breault finished second with Randy Carrington in third.

The Amateur B main was a class of really fast semi-pro drivers. The lap times of these drivers were convincingly quicker than the Novice drivers. Seasoned driver Loren Sachs managed to grab the lead only two minutes into the race and sat there for the rest of the race. Lee Criger finished a few laps down in second, with Ron Heigl in third.

At the start of the Amateur A main, Marty Desbrow jumped out in front with gobs of horsepower and had to come off the power early for the turns, costing Marty a couple of meetings with the walls. This later turned into an unscheduled pit stop that let Jeff Maurer and Tom Bowlin blow by. Marty returned quickly, and the result was a hot battle that lasted almost 10 laps. Bowlin got drilled and the airborne car hit the barriers and then some. Bowlin's car didn't survive and was pitted for the evening. Meanwhile, Desbrow walked away from a few other incidents and managed to hang on for the win, with Maurer always within striking distance. Jeff Deacon was third.

There was horsepower galore in the Expert B main and early leader Frank Killam used a lot of it. Jerry Case had some too and he chased Killam most of the way, actually passing Frank several times only to get careless and roll the car. About 6:30 in the race, Case put Killam away and opened up a sizable lead. It looked like the victory lane for Case, but he dumped his battery 15 seconds from the end, and, with only two turns to go, Killam blasted by and stole the victory.



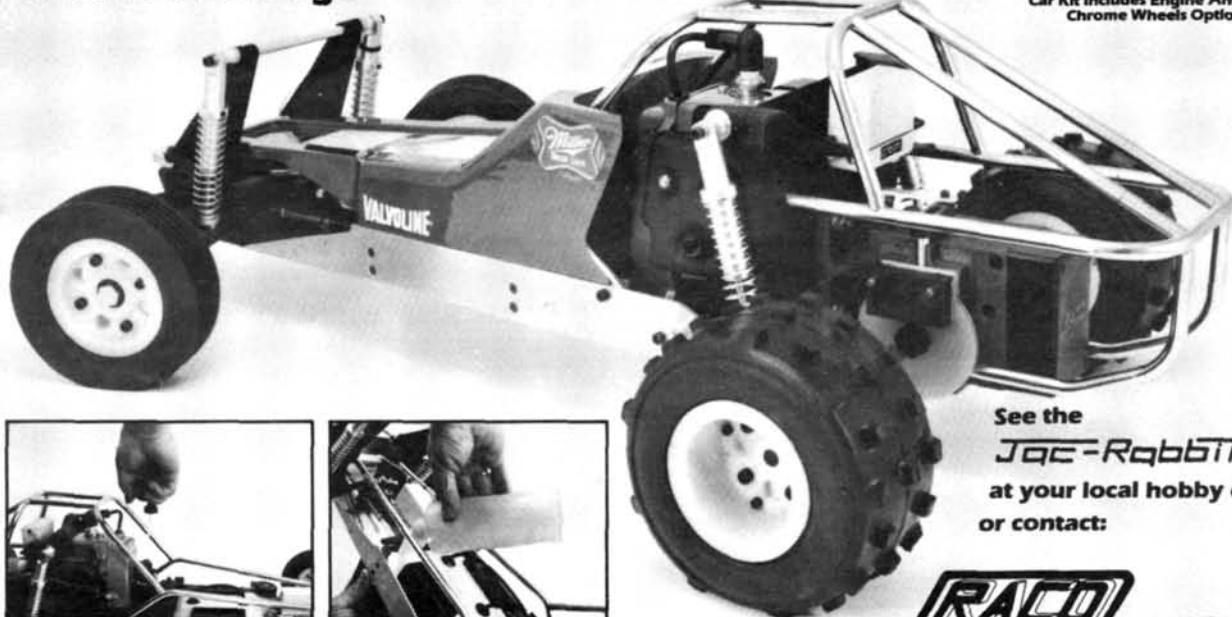
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1421 east saint andrews place, santa ana, cal. 92705

Mace Horowitz finished third.

The Expert A main was the fastest of the fast, with two well-known World Champion drivers in the field. Tony Neisinger and Kent Clausen showed up, both with little practice on the carpet. Clausen had fits with his car in the heats, as it refused to slide through the turns. But Kent didn't make champion status for nothing. His car suddenly handled in the last heat and he almost captured TQ. At the start of the main, Neisinger, Rick Hohwart, and Clausen drag-raced down the straight and left dust for the rest of the pack. Neisinger and Clausen changed off a couple of times, and then Hohwart started the swapping as well. In the heat of the battle, Clausen's car got nailed through turn one and that put air between the car and the track. The resulting crash totalled the car and put Clausen out.

Meanwhile, Neisinger ran away and by the 3-minute mark, already had a lap on second place. Somewhere along the halfway point, Hohwart began making a serious move on Neisinger and by 6 minutes, was within 20 feet of the lead. It was a great try, but Neisinger did an outstanding job of driving and took the

win. Hohwart was second and Tim Copp third.

The bigger 1/10 two-wheel-drive cars seemed a lot slower and bulkier around the track. However, Larry Grant reflected lap times right out of the 1/12 Expert class drivers. Larry had tons of punch and he had a heyday driving to an easy win. The real battle went on for second with Marty Desbrow and Rick Atwood drafting each other for almost the whole race, *a la* stock car style. Desbrow took the final swap and captured second with Atwood getting a hard-earned third.

The 1/10 four-wheel-drive class was another case of sheer horsepower on a fast track that equalled winning. Tony Rossetti took a converted Associated RC10 and ran away from the pack and the TQ man, Jerry Case. Rossetti just wasn't challenged in the least and he made this Sunday drive look easy. Case was second followed by Loren Sachs.

The BoLink Invader class was an interesting race to watch, as the identical Invaders took to the track. They handled the track the best with most all drivers making it look easy. Frank Killam took off early and was chased down by Larry

Grant. Grant had the punch and caught Killam in the straights. Killam made his moves in the turns and the seesaw battle ended when Grant contended with traffic via body contact and Killam got away. Killam made a clean sweep as the top qualifier, trophy dash winner, and main winner. Grant finished second and Linda Gupta got third.

Let me tell ya, this kind of racing is definitely fun, although I'll think twice next time a lady wants to pass my car—especially if I can beat her! Driving the big stock car bodies is like driving bread boxes and requires some very different suspension tuning. Come next year and get into the race, Grand Nationals style. ■

MRC HORNET

(Continued from page 51)

it a comfortable fit in your hands. The receiver, battery pack, and two servos (one each for speed control and steering) fit into the allotted space with no problem.

The kit itself is well-thought-out with all of the required parts located in either numbered packages or on "trees" in the

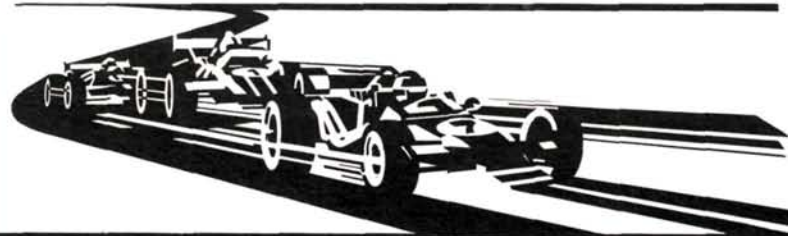
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MRC HORNET

case of molded items. The 18-page assembly manual is well illustrated with step-by-step instructions to eliminate any problems.

Tamiya uses the right material for the different parts by molding nylon for gears and high-impact plastic for the major components, and by supplying metal shafts, shocks, and linkages. The transparent polycarbonate body and rear wing require only trimming and washing in detergent prior to painting.

The Hornet is powered by the RS-540S motor, which will propel your Hornet at a rather brisk clip. Higher performance motors are available as after-market accessories but, generally speaking, greater power will come at the

expense of endurance. That simply means you might go faster, but not for as long!

ASSEMBLY. The actual assembly of my Hornet took two evenings, with a third devoted to painting. I experienced no assembly problems by following the exact sequence provided in the manual. I would recommend that you have your radio system available while you're assembling the car; once you get started, you'll find it hard to put the project aside while waiting for your radio. It would be a good idea to charge your battery pack at this time also; there's no reason to wait until you've finished assembly, the dunes are calling!

I painted the body and wing after washing the parts in detergent and warm water. This removed any residual film

that might have been deposited during the molding process. I used paints made specifically for these type bodies. I'm not sure what makes them special, but they stick very well, even after repeated "bashings." The unusual part of the painting process is that it's done on the *inside* of the body rather than on the outside. (Just like the old 1/32 and 1/24 electric slot cars for those of you old enough to remember.)

I painted my Hornet white and yellow and finished the body using the extensive sheet of self-adhesive, multi-colored trim decorations. These take a bit of slicing and trimming to get around corners but, once applied, they are very attractive and hold up well. I personalized my car by adding names, including "Air Age Racing," with transfer lettering purchased at an art supply store.

PERFORMANCE. Running the car is a ball! After many hours of hard driving in snow, mud, dirt, and puddles, the Hornet has shown the stamina of a thoroughbred—nothing has broken and, although the body doesn't look as squeaky clean as it used to, it's still in pretty good shape. About the only thing I see on the horizon is a new set of rear tires, as mine are starting to look like racing slicks!

After running this car, it's easy for me to understand its widespread popularity. It's competitively priced and a great performer. If you're just getting into off-road, try one. If you're already in, try one. It's a great machine and more fun than MTV!

**The following are the addresses of the companies mentioned in this article:*

MRC-Tamiya, 2500 Woodbridge Ave., Edison, NJ 08817.

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ELECTRIC MOTORS

(Continued from page 77)

lint, and anything else found on the ground, is going to get a shot at your motor. Make sure you clean it out. To remove dirt and dust, a motor cleaning spray such as Associated's Reedy-In-A-Can Motor Spray is very effective. Another more thorough cleaning method is to totally dip the motor in cleaner, such as Electro-Whirl from BoLink-Champion. This cleaner is totally non-flammable and non-conductive. Simply drop the motor into the cleaning solution and apply a little power to the motor while it's submerged.

If any part of the motor needs to be cleaned often, it's the commutator. Both types of cleaning are very effective. As I mentioned before, the brushes are in direct contact and they wear away quite fast. The residue from the brushes is hopefully expelled out of the can vents, but a good deal of it manages to get lodged in between the lands of the commutator. This residue will conduct electricity, causing the timing to go wrong, or in severe cases, cause shorting of the armature.

The bearings of the motor also require frequent service in order to keep them happy. While most Stock class motors are restricted to plain bronze bearings, upper-class motors, such as the LeMans 240, feature ball bearings. Both types require frequent and thorough lubrication in order to work well. A light machine oil, such as 3-In-1, works well.

Lack of lubrication will cause the bearings to run dry and fail. A failed bronze bearing could seize up and cause the motor to overheat. A dry ball bearing can also seize up; however, they usually self-destruct shortly afterward, making a real mess of the motor in the process.

When I mentioned that shunts prevented electrical resistance, I also mentioned that the brushes are held in place with springs to maintain contact with the commutator. You can ensure top performance here by checking the brushes and springs. Brushes should be free to move within the brush housing. Any dirt or grit will cause them to hang up and you'll lose contact with the commutator. The motor then stops.

To clean the brushes, carefully remove the brush springs and slide the brush out. It should come out easily. If not, spray the housing with motor spray to clean any debris. Now, inspect the brush for cracks or chips. A cracked brush will usually fail quickly and should be replaced immediately. A chipped brush will work, but it indicates that there may be other debris floating around that should be removed.

Now check the springs. They should have good tension and spring back to their exact position when compressed. If they don't, replace them because they will surely fail you later on. The spread of the spring ends should be at least 100° or more to be effective. Once checked and found to be satisfactory, replace the brushes and springs to their original positions.

Lastly, check the motor wiring for any worn or broken wires. Take a look at the main power wires in particular. These wires must maintain full contact with the

power lugs, or you could find that you're not getting all the power possible. Use a multi-strand, high-voltage, and high-temperature wire for motor power requirements. That will ensure that all the available power is getting to the motor.

The electric motor is quite a science. When running right, they are one of the cleanest and most efficient power sources around. And for all of us car sportsmen, they're the answer to a lot of prayers. Treat your motor with respect and TLC,

and it will provide you with everything its little heart can give you. It's been the key to our sport, and it now enjoys being the very soul of the sport. It's easy to maintain it when you know how, and now you do. Keep 'em running and keep 'em clean.

**The following is the address of the company mentioned in this article:*

Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820. ■

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R/C ELECTRONICS

(Continued from page 10)

"3. Set the steering end-point adjustment trimmers, left fully counterclockwise and right fully clockwise. Set steering trim knob to its center or "O" position.

"4. Turn the steering wheel to the left and right to check for the proper steering directions. If the direction is backward, use the steering servo-reverse switch to correct.

"5. Turn the steering wheel fully right then left while observing steering travel of the car. Ideally, you should have just a little more throw than needed. If there is not, make the mechanical adjustment necessary to meet this condition before proceeding.

"6. Turn the steering wheel fully to the left and hold it there. Now adjust the left steering EPA for correct maximum amount of left turn.

"7. Turn steering wheel fully to the right and adjust steering EPA for maximum amount of right turn. Make sure that the amount of throw to the right and left are equal, unless you desire to have more throw in one direction than the other.

"8. The first time that you run your car, set the steering rate thumbwheel to approximately the center, and the steering trim knob also to center or "O." If the car tends to veer off to the right or the left with the steering wheel in the center position, correct it with the steering trim knob until the car travels in a straight line. It may be necessary to mechanically re-adjust your steering linkage back to neutral at this point."

The steering rate thumbwheel controls the overall throw of your steering servo. By turning the thumbwheel to the right, the steering travel will increase and turning it to the left will cause travel to decrease. You can change the steering travel to suit the track while running with the steering rate thumbwheel.

The following additional optional accessories are available for the Circus 2 Winner radio: JRB500—Receiver Nickel-Cadmium Battery Pack (flat); JRB500S—Receiver Nickel-Cadmium Battery Pack (square); JRA001—Switch Harness (with charge plug); JRA016—4 Nickel-Cadmium Cells with Battery Charger; JRC121—Transmitter/Receiver Battery Charger; JRA058A—Speed Control with Brake; and JRA058—Speed Control with Reverse.

The Circus 2 Winner currently retails for about \$90. It's a quality radio set and has proved to be very reliable. I'm

currently installing nickel-cadmium batteries, a topic I'll cover in a future column. Take a look at the Circus 2 Winner. It's a lot of radio for the money.

**The following is the address of the company mentioned in this article:*

Circus Hobbies, 3132 S. Highland Dr., Las Vegas, NV 89109.

MARUI BIG BEAR

(Continued from page 63)

grooves on the tires face the front.

Attach the spring-mounted front bumper to the chassis. Assemble the steering linkage onto a servo and mount the whole subassembly to the chassis. Adjust the ball ends (top part of the ball joint) for a slight toe-in to improve the vehicle's straight-travelling performance.

This is the point where I encountered the only assembly problem. The tie-rod was too long, preventing the required toe-in adjustment. I removed the tie-rod from the servo, and cut off enough of the threaded portion to allow the required front-end alignment. I then put the tie-rod back onto the steering servo and made the required front-end alignment.

Next attach the second servo to the mechanical speed controller using double-sided tape. To achieve the proper forward, stop, brake, and reverse positions, install a mechanical linkage between the servo and the speed controller.

Proper speed controller adjustment was easy with the Futaba servo.

Using double-sided tape, mount the speed controller subassembly to the chassis. I mounted the receiver in the back of the chassis instead of the front, on top of the steering servo. Secure the receiver batteries and racing pack in their respective compartments with heavy-duty rubber bands.

Paint the driver, the vehicle's interior, and the body, assemble them, and then mount them to the chassis and you're ready to go.

DRIVING. Charge the racing pack, put it into the battery compartment, attach the body, switch on the transmitter first, then the receiver, and start getting the feel of Big Bear.

Driving Big Bear is a lot of fun, whether you're driving it off-road in the dirt or on-road where it attracts all the neighborhood kids who are eager for a turn at it themselves.

I decided to buy an electronic speed controller. Fortunately, Futaba recently began selling a moderately-priced electronic speed controller that also features brakes and reverse. Most speed controllers on the market are more expensive and don't have these features. The Futaba FP-MC108 replaces the mechanical speed controller and servo, as well as derives power from the racing pack instead of from separate receiver batteries. You no longer have to worry about the condition of the receiver batteries. The radio receiver switch on the

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MARUI BIG BEAR

FP-MC108 also turns off the racing pack and is very easy to install.

I was concerned that when the racing pack ran down, the motor would keep driving Big Bear and I would lose control. This is not the case. When the racing pack does run down, there isn't enough power to run the motor, but there is still enough for the radio receiver. However, if you keep trying to drive the car, it could go out of control. As long as you stop when the batteries are beginning to get low, you won't have a problem.

Performance was greatly improved with the electronic speed controller. Braking was instantaneous with no servo lag, and reverse was as fast or as slow as I wanted it.

Big Bear will easily do wheelies too; just back up a little, then accelerate quickly. With a little practice you can do wheelies without dragging Big Bear's tail on the ground.

When I run Big Bear I use several racing packs; one is in Big Bear, one is cooling, and the third is charging. I put resistors across each racing pack to completely drain the nickel-cadmium batteries when I'm finished running and don't plan to drive Big Bear for a few days. This lengthens the life of the racing packs.

I bought a 30-ohm, 5-watt resistor for each racing pack from a local electronics store and soldered them to the racing pack mating connectors. Now I connect the resistors to the nickel-cadmium racing packs for a day or two to drain them. Then I remove the resistors and store the batteries until I'm ready to charge and use them again.

Big Bear is enjoyable to build and is a blast to run. It can get in and out of places that most other cars can't. If you're looking for this type of vehicle, I'm sure you'll enjoy Big Bear as much as I do.

**The following are the addresses of the companies mentioned in this article:*

Model Expo, 23 Just Rd., Fairfield, NJ 07007.

Futaba Corporation of America, 555 W. Victoria St., Compton, CA 90220. ■

BATTERY PACK CARE

(Continued from page 81)

the red wire goes to positive poles and the black wire goes to negative poles.

Test the new pack to make sure it's wired correctly. Connect a simple voltmeter to the battery pack and read the voltage. It might not read very much if these are new batteries with no charge in them. You're looking for a reading anywhere around 6 to 7.5 volts in the positive DC range. If the reading isn't positive, then a battery cell might not be connected correctly. A negative reading of similar voltage means that your polarity might be crossed, with red to negative and black to positive. If there is no reading at all, you either have a bad solder joint or a battery in the pack isn't connected in series. If the meter reads correctly, congratulations, you have just made your own battery pack!

For most car applications, this type of battery pack will work great. Aligning the battery cells side-by-side is an alternate way to make the same 6-cell pack. The physical size will be the same.

Now that the tough part is over, you can concentrate on taking care of that pack for long life and plenty of action. Start out with charging; there is a way to do it right!

When you're charging a battery pack for the first time, charge it slowly on a trickle charge. A trickle charge means that the rate of charge is about $1/10$ of the actual battery capacity per hour. For example, our cells are rated at 1,200 milliamps per hour. That means that in one hour, the battery cells can produce 1,200 milliamps constantly. You should trickle charge this cell at $1/10$ that rate, or 120 milliamps per hour. At this low rate (known as the C-10 rate), you can safely charge the battery pack overnight with little chance of overcharging the pack should you forget about it.

The C-10 rate charge will do two things for you. First, it will safely charge the batteries and allow all the cells to reach their full capacity. Before charging, some cells might have a bit more charge in them than others. The slow charge allows the cells that top off before the others to sit comfortably and wait for the rest without overheating. Second, it prevents the possibility of cell shorting or reversing. A fast charge right off the bat can turn a good cell with no power into a ball of fire should it short out. Cell shorting or reversal will normally happen when the cell is dead on power, and the fast charge will only push it over the edge.

The slow charge phase should last about 10 hours, or overnight. From here, you can use the batteries as you wish and you can begin using fast chargers.

There are two distinct types of fast chargers. The first type is the constant-current charger. This can be as simple as a resistor-type wire from a 12-volt source to the battery pack, to the more sophisticated metered and timed units. Most all work the same way.

The constant-current charger provides the battery pack with a constant amount of voltage during the charging phase. It depends on either a timer or the modeler to manually time the charge. This type of charger has no way of detecting an overcharge on the battery and turning itself off. Consequently, if the charger is allowed to overcharge the battery, the pack can be destroyed.

Many of the constant-current chargers feature automatic timers that allow you to set the amount of charge time. When the timer runs down, the charger goes into a trickle-charge mode to maintain the battery at top charge. More expensive models also feature meters to monitor the amount of power being fed into the battery pack at any given time, but aren't indicators of overcharging. It's a good idea to monitor them closely.

The other type is the peak-detecting charger. This charger will charge a battery similarly to the constant-current charger, but has special circuits built in to monitor the voltage at the battery pack. When the battery pack has absorbed all the power possible, the circuits detect a fall in voltage and automatically cut the charger off. These are very safe chargers, but a bit more expensive than others. If you're a serious competitor, the peak-detecting charger is the only way to go.

Now let me explain what a peak is. A peak charge is the amount of power that a battery can hold at best. In a nickel-cadmium battery, the peak is measured in voltage. However, nickel-cadmium

batteries also have one characteristic that provides this power peak. When a nickel-cadmium battery has reached full power capacity, it cannot take on any more power from its charging source. If the charging source is still throwing power to the cell, the cell has to somehow get rid of the excess, and this is done by generating heat. Heat from the overcharging cell will cause the cell's electrolyte to expand and create internal pressure. When enough heat and pressure are generated, the cell vents.

Venting is when the cell is forced to release excessive pressure to keep from exploding. This process usually causes electrolyte to escape, thus degrading the cell's performance. In other words, it will no longer hold as much power as it used to. If you find a trace of white powder around the positive post of the cell, it has probably vented. Replace vented cells rather than pushing them any further. They will no longer do the job they were made for.

The battery cell can tell you when it's fully charged by reading the voltage. The cell will reach its maximum peak of power right before it goes into overcharge and heats up. At this point, the battery begins to lose power to heat. The precise moment the power begins to fall is the peak and the battery is charged to the max.

As I mentioned, peak-detecting chargers automatically keep an eye on the battery voltage and cut off the charge when the peak is reached. But for those who have a standard constant-current charger, there is a method of detecting a peak charge. It only requires the addition of a digital voltmeter; analog meters don't have the precision reading capability that a digital meter has.

To detect the peak, simply hook up the battery to your charger as you

normally would, and place the meter probes on the wires from the battery. You'll need to set the meter in the 0-20 volt range. Begin charging and note the time. As the charging process takes place, the meter begins reading the voltage climb. It will start tapering off after about 17 minutes or so. What you want to watch for is the first time the voltage drops down .01 volt, or $\frac{1}{10}$ volt. This is the voltage peak and charging is complete. If you have carefully noted the time, you can use it as a standard charging time for your pack to reach full charge.

Now, how do you maintain the good power characteristics of the battery pack? In most cases, a little TLC will do. However, cycling the battery is a must. Another funny thing about nickel-cadmium batteries is that they remember how much power is used, which is known as "memory."

Memory is caused by the constant charge and discharge of a battery at a very consistent rate. For example, if you use 90% of the battery's power and then charge it back to 100%, 10% is still in the cells. The memory effect occurs when this type of cycle occurs many times. The memory will set in and, from then on, the battery will provide you with the same amount of power you've been using (90%), only this is now 100%. You lost the other 10% to the memory.

To keep from suffering the memory effect, you should exercise the battery once in a while. Simply discharge the battery until there is no charge left in the pack. Most drivers will do this one of two ways. The first way is to allow the car to run until it stops. The second method is to discharge the batteries through the discharge circuit in their chargers, if there is one. Either method gets the job done quickly.

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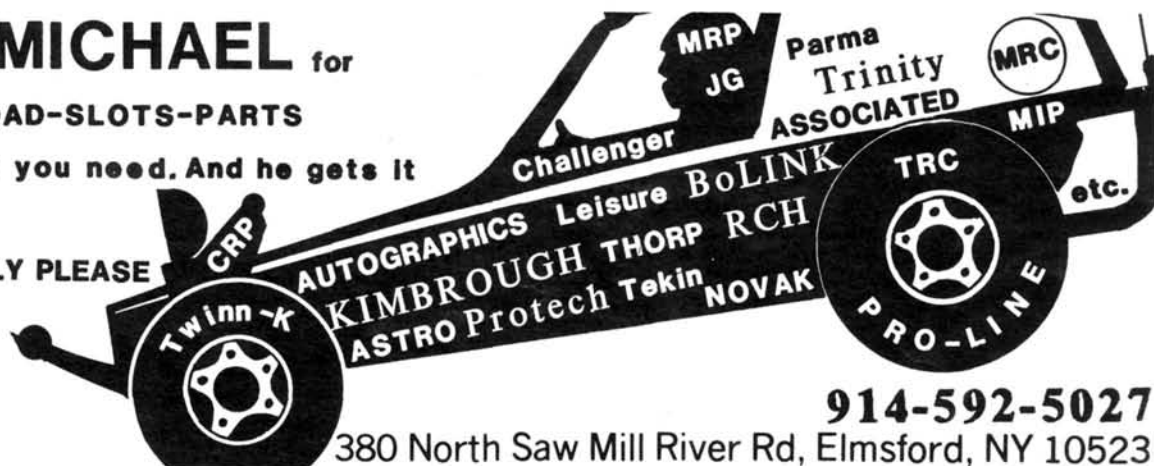
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BATTERY PACK CARE

A deep discharge of this type will erase the memory effect and provide you with a battery that will once again take on a genuine 100% charge from the chargers.

The last hint on caring for a battery pack is something that time can cure. In most racing situations, we place a great demand for power on the batteries. This demand causes the batteries to discharge their power at an extremely high rate. When this high discharge rate is called for, the chemical process in the battery (the electrolyte process) is called on to make electricity from the electrolyte. A high demand means a fast chemical reaction, and a fast chemical reaction results in heat.

It's not uncommon for the normal racing car to come back to the pits with a pretty warm battery. The chemical reaction that caused the heat has also produced pressure in the cells, and they must be given time to rest. That means you should always allow your battery pack time to cool completely before recharging it. A warm or hot battery cannot accept a full charge because the electrolyte is still stirred up from the discharge and won't readily accept the recharge. Always allow a pack to cool before you recharge.

Battery pack construction and care is really easy if you take the time and thoughtfulness to do it. Making your own pack will save you money and taking care of it will save you even more by making batteries last much longer. In the end, that makes you the winner every

time. Have a little love and respect for your batteries, because things could be worse—we could still be using non-rechargeable batteries! ■

HANDLING

(Continued from page 89)

probably turn more easily in one direction than in the other. If the measurements are off by more than 2% (.2 inch in 10 inches), correct the problem.

Before performing your first driving test, set up the camber, caster, and toe-in to approximate settings. You can refine these later, but for now, the following will get you into the ballpark. If camber and caster are not adjustable on your car, they have been factory-set to the best compromise position.

If your car has adjustable camber, move the adjustment to the center of the setting, or set it according to the instructions that came with your car.

Because of front-end geometry and servo steering arm angles, many off-road cars change toe-in to some degree when the suspension moves. Consequently, you need to set the toe-in at the position the suspension takes when the car is sitting on its wheels with the battery aboard. Note how far the suspension is compressed.

Install both front wheels onto the car, but leave the tires off the wheels or at least make the following measurements at the wheel rim rather than the tire. (Any tire wobble will spoil your measure-

ments.) Turn your car upside-down, compress the suspension to the correct ride height, and measure the distance between the front wheels, first at the rearmost point of the wheels and then at the foremost point. (See diagram.) If the front measurement is less than the rear measurement, you have toe-in.

As a starting point, I suggest a toe-in of 1° for each front wheel, but if your car is one of those that changes toe-in radically during suspension movement, start at 2° and be sure to set the toe-in at the normal ride height.

To arrive at the correct toe-in for your car, measure the diameter of your front wheel and plug this figure into the following formula, along with the decimal figure taken from the column labeled "Tan."

Tan.

1° = .01746

2° = .03492

3° = .05241

4° = .06993

5° = .08749

Wheel Dia. x Tan. x 2 = _____. For example, wheel diameter = 40 mm, Tan. 1° = .01746. The formula now looks like this: 40 mm x .01746 x 2 = 1.4 mm (rounded off).

When the measurement between the foremost points of the two front wheels is 1.4 mm less than the measurement between the rearmost points of the front wheels, the toe-in is set at 1° for each front wheel. Simple. If you use inches in the formula, then the result is in inches.

Again, you may have problems of

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camber changes as the suspension travels, so let's begin by loading the car to its normal ride height. Now, using the same formula used to figure toe-in, set the camber at 2° negative each wheel, that is, with the top of the wheels leaned in toward each other.

Using the formula, if your wheel is 2.4 inches in diameter, we have: $2.4 \times .03492 \times 2 = .17$ inch (rounded off).

Thus, when the distance measured between the wheels at the top is .17 inch less than the distance measured between the wheels at the bottom (see diagram), the camber is set at 2° negative each wheel. This is normally a good starting figure and you should set the rear wheels to this point also. Different tires will tolerate different camber settings. Generally speaking, the more rounded the tire is, the higher the setting of negative camber that you can use, but don't overdo it. Too much is not just right!

Test. At this point you have a car with very little suspension slop, full suspension travel, and approximate camber, caster, and toe-in settings.

Pick a level area with normal-size bumps, but not whoop-de-dos or jumps. Use the bumpy straight section on your local track, for instance. Drive the car directly away from you while keeping your eyes on the rear suspension. As you reach racing speeds are your rear tires chattering off the ground at most every bump? If so, stop and lower the spring tension by moving the adjuster. Did this change allow the suspension to follow the bumps more closely without bouncing the car off the ground? If it did improve things, reduce the tension on the springs a bit more and retest. If improvement continues, keep softening the rear spring tension until the chassis starts to come close to bottoming out on the bumps or no further improvement results. If your car has non-adjustable springs or if removing some of the tension doesn't improve the bump control, reduce the weight of the oil in your rear shocks and retest. Note that the springs and the shocks work together, so you must achieve a balance. As a matter of fact, the shock absorber is not really a shock absorber but a damper. Its purpose is to slow down the action of the spring and to control rebound. Otherwise, when a wheel hits a bump, the spring would compress and as soon as the wheel traveled past the bump, the spring would uncoil and bang the wheel down against the ground, which would cause it to bound into the air again and again, etc.

Strike the balance that best allows your car's rear suspension to follow the bumps without jolting the car so that it becomes difficult to control. Generally, we tend to run our off-road suspensions too stiff, so don't be shy about softening it up until your car starts to bottom out in the bumpy stretches.

Now perform the same test with the car approaching you and adjust the front spring/shock units the same way you adjusted the rear.

If you haven't already done so, now is the time to start keeping a log book that shows the changes you've made and the results. That way, you can always go back to a setting that works if you get too far off. You'll also develop the correct setup for various tracks and surfaces. That's quite an edge when you're at a new track or when conditions change on your own track.

I'll cover "dialing in" adjustments in a future column, but for now, go drive your car. It'll be faster and a lot easier to drive. ■

MUGEN BULLDOG II

(Continued from page 48)

away excess material as indicated by molded cut lines. The best cutter I've found is a pair of Fiskar's sewing scissors—try your local sewing shop.

I wasn't looking for a multi-color paint job so I simply sprayed the inside of the body (after masking the windows and lightly rubbing with 400 finishing paper) with a white acrylic enamel. I decorated the exterior with the set of vinyl stick-ons provided in the kit. I also used stars from Coverite's* fine "Graphics" line. You can spend hours on a car paint job, but I find the simple approach to be attractive and any running damage doesn't upset me since I put such little time in the finish. By the way, before painting, drill any mounting holes or antenna holes since it's so easy to see where they should go when the body is clear.

PERFORMANCE. I live on a small side street in a quiet (at least when I'm not running model engines) suburban town. The local residents have accepted (tolerated) the idiosyncracies of the nice old man (idiot) living in the gray house for more years than I care to remember. These folks, over the years, have tolerated engine noise, test flights on rubber-powered airplanes, R/C airplanes being taxied up and down, wayward hand-

launched gliders, and a variety of gas- and electric-powered cars running on the street. With the Mugen Bulldog II, however, I finally caught their attention—their positive attention.

My first runs were, as usual, right outside my home on the public road (not too many full-size cars come by and the locals are always, I suspect, looking for me!). First runs showed steering to be a bit sensitive and I solved this by moving the front steering rod to the inner hole on the servo arm. I also reduced rear wheel steering to a very low level—perhaps only 3° or 4°. The desensitized steering proved just right and the Bulldog roared up and down my street like a champion. It was, with slight toe-out on the front wheels and minimum toe-in on the rear, virtually impossible to spin out, even on high-speed turns. I guess I spent an hour or so running, charging, and adjusting.

At this point, some of my neighbors decided I was not the only one to have fun and soon a small group gathered—all looking for a turn at the "nice old man's" latest toy. The Mugen Bulldog II had turned into a local happening. At least six of my neighbors had a turn at the wheel.

I relate this story only because all the neophyte drivers proved that running an R/C car can be learned very quickly. That is, with the exception of one neighbor who tried to stuff the Bulldog into a sewer drain! Now all I have to do is set up a course, get those neighbors to build their own cars, and start weekly competitions.

The Mugen Bulldog II is, of course, a great competition off-roader. It's as fast as anything I've previously assembled and it can handle the roughest course. The car is very rugged with no bad handling characteristics when properly set up. At a touch under 3½ pounds, it's 7.2-volt Mabuchi power drives it to competition levels right out of the box.

The radio for this project was Airtronic's* two-channel CS2P system in pistol-grip format. I've used Airtronics radios for years and all have proven to be very effective with very long life; this latest one was no exception. Range was more than needed and the pistol-grip and wheel control had a natural, positive feel.

This system has a number of features ideal for car operation, not the least of which is exponential control of steering. Expo gives a very soft neutral, while still retaining full throw at extreme throw. This feature can make any driver look

(Continued on page 110)

Coming Events

MRC-TAMIYA SCORE SHOW U.S. Off-Road Championships Anaheim Convention Center Butch Dunn 818-341-0842 or Ron Williams 714-631-1555

June 20-21—Off-road returns to the Anaheim Convention Center with the running of the first-ever MRC-Tamiya U.S. Off-Road Championships. Four classes will be run: Tamiya Stock, Tamiya Open, Heavy Metal 2WD or 4WD Open (truck bodies only) and 2WD Open Class. The first two are for the MRC-Tamiya off-road cars only. Entry \$30 one class, \$50 two classes, \$80 three classes, and \$100 for all four classes. Event is in conjunction with the Score Off-Road Show. Special celebrity Team Race with identical Hornets. Event co-sponsored by CRP, Airtronics, MIP, and Pro-Line. Limit on entry, so sign up as soon as entry is published. Call Dunn or Williams for more details. **FLASH! The A Main winners in the Tamiya Stock and Open classes get a free trip to Hawaii, hotel for one week, round-trip air fare and an entry to the Hawaiian State Championships.**

ROCKY MOUNTAIN R/C RACEWAY 5827 W. 52nd Ave., Denver, CO 80212 303-431-8868

June 14—Off-road.
July 12—Tri-oval.
Overall trophies for Top Qualifier, Stock Tamiya Class, Stock, Modified, 2WD Open, and 4WD Open.

SOUTHERN CALIFORNIA ORRCA SERIES 818-340-5750

Series II:
June 15—Radio Controlled Hobbies, Costa Mesa, CA.
July 20—Hobby Bench Raceway, Glendora, CA.
ORRCA membership required. You can buy "day membership" at the track or full membership on race day. Entry \$7 per class. Trophies for A, B, and C Mains with "bump-up." Four-minute heats and mains. Drop one race from each series for overall position.

REGION 6 1/10 OVAL SERIES Al Hess, 24201 Kirby, Hemet, CA 92343

June 8—Metro Raceway, Bakersfield, CA; Al Sandrini 805-322-7955.
July 5—Hobby Bench Raceway, Glendora, CA; Brandon Peterson 818-963-9517.
August 3—Lance's Pit Stop, Riverside, CA; Lance Love 714-780-9196.

NYROC (New York Radio Operated Cars) Joe Fiero 718-272-1917 or Larry LaBounty 203-763-1940

Series East 1/8 Scale Gas Series—Run at two track sites: Brooklyn, NY, and Enfield, CT.

MIDWEST "SPRINT CAR" SERIES c/o Moody Automotive, 755 Ash St., Flossmoor, IL 60422 Roy Moody 312-799-5597 or Harold Miltchum 419-435-4675

June 14—Fostoria, OH; Race 2 includes NORODS Spring Classic.

June 27-29—Braxton, MS; 4th Annual Sprint Nationals.
July 12—Chicago, IL; Race 3.
August 2—Fostoria, OH; Race 4.
August 30—Painesville, OH; Race 5.
Joliet track located at Rte. 30 and I-55, Fostoria track located at U.S. 23, south of State Rd. 12 (in back of the County Line Machine Co.)

GOLDEN T R/C RACEWAY 11th and Ramirez Sts. (not a mailing address), Marysville, CA Gordon "GT" Tom 916-741-2155

June 1—Modified.
June 15—Stock.
June 29—Modified.

RIO GRANDE RACERS El Paso, TX Jerry McGinnis 915-591-9271

June 1—Can Am.
All races at Vista Hills Center. For more information contact President Bob Blum 915-593-8015 or Race Director Bob Akins 915-821-7563.

R.O.A.R. 1/12 ELECTRIC NATIONALS Della Wilson, 8539 Kern Canyon Rd. No. 169 Bakersfield, CA 93306; 805-366-2744

July 7-12—Reno, Nevada, at the Peppermill Inn and Casino. R.O.A.R. membership required. Stock entry \$25, Modified entry \$20, both classes \$45. Late fee after June 7. Special room rates. Presented by the Silent Modified entry \$20, both classes \$45. Late fee after JPower Contest Club.

REGION 6 MIDWEST SERIES P.O. Box 69, Wauconda, IL 60084 Steve Lazarus 312-526-1493

June 28-29—St. Louis, MO.
July 19-20—Detroit, MI.
August 16-17—Toledo, OH.
Three classes of gas cars: Pan Class, 2WD Suspension, and 4WD Suspension. Trophies for top three and TQ.

PARMA AMERICAN OFF-ROAD CHAMPIONSHIPS 13927 Progress Pkwy., N. Royalton, OH 44133 216-237-8650

August 22-24—Off-road, presented by NORCAR at its track, which is located 5 miles from the Hopkins Int'l Airport. Send SASE for entry information.

PARMA PRESENTS 1986 CANADIAN OFF-ROAD CHAMPIONSHIPS 115 Feildrow Dr., Nepean, Ontario, K2G 2Y8, Canada Jeff Nidd 613-224-2395

July 19—Parma International and the Ottawa Valley Racers (O.V.R.) present the First Annual Canadian Off-Road Championships for 1/10-scale electric cars. It will take place at Hobby Sport Canada, Ltd., Nepean, Ontario, on the O.R.V. track. There will be a Two-wheel Stock Class and an Open Class. Entry fee \$15 (Cdn) per car. For entry form or further information, contact Jeff Nidd at address and telephone number above.

information, contact Jeff Nidd at address and telephone number above.

IFMAR 1/12 SCALE WORLD CHAMPIONSHIP Tropicana Hotel, Las Vegas, NV

August 11-16—The Electric World Championships will be sponsored by Sanyo Batteries. Entries for qualified racers due by May 15, 1986. Special hotel rate for racers and also a special package for enthusiasts. For more information, contact the IFMAR World Championships at 20431 Castle Rock Circle, Huntington Beach, CA 92646, Attn. Monica Barana.

CALIFORNIA AUTO RACERS Don Hill, 1658 Provincetown Dr., San Jose, CA 95129 408-973-9622

June 8—Sports, Road.
July 13—Sports, Road.
July 19—6-hr. Enduro.
August 10—Sports, Road.
August 23-24—Silicon Valley Invitational.
Club meets at D&J Hobby Shop in Campbell. Race 1/12-scale electric. Racing on second Sunday of each month, except May and Dec.

R.O.A.R. NATIONALS Ranch Pit Stop, 1655 Mission Blvd., Pomona, CA 714-623-1555

July 23-27—1/10 Off-Road, no other information available at this time.
August 28-31—1/8 Gas, no other information available at this time.

NORODS Northwest Ohio Radio Operated Dirt Sprints Herb Zielem, 906 Eton Rd., Toledo, OH 43615 419-531-0070

June 14—Sprint series and Spring Classic, Invitational, Fostoria, OH.
June 21—Club race 2.
June 29—Sprint Nationals, Baxton, MS.
July 12—Sprint series 3, Joliet, IL.

FLORIDA STATE 1/12 SERIES SCHEDULE 11850 Northtrail Ave., Tampa, FL 33617 Eric Gudger 813-985-6158

June 21-22—Can Am in Miami. Contact David Beren 305-791-7652.
August 2-3—GTP only, in Daytona. Contact Dick Shafer 904-761-7365.

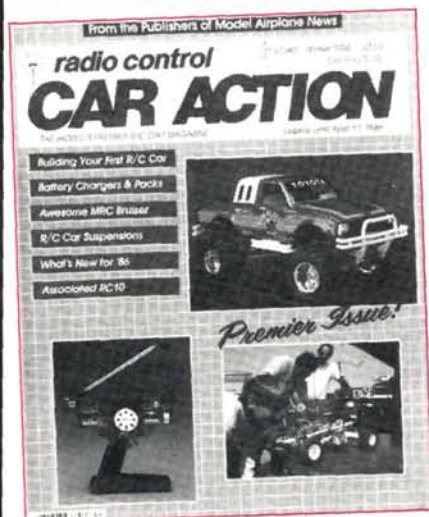
NORCAR (Northeast Radio Control Auto Racers) 36 Glendale Rd., Enfield, CT 06082 Larry LaBounty 203-749-6281

June 1—Oval race.
June 22—Road race.
July 6—Oval race.
August 10—Oval race—ASA Special.
August 24—Road Race Series East.

(Continued on page 112)

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MUGEN BULLDOG II

(Continued from page 107)

better on the straightaway since it diminishes the tendency to over-control. Throttle is trigger-operated with adjustable brake action. There are end-point adjustments on steering and throttle, dual rate on steering as well as the aforementioned expo. All channels are reversible by switches. Frankly, I find the pistol-grip, wheel operation to be the most comfortable, natural system for vehicle operation and I highly recommend Airtronic's version to anyone looking for a car radio.

All in all, I think anyone looking for a great performing off-road R/C vehicle will be pleased with Mugen's Bulldog II. The chassis has already been a winner in competition and it can be a winner for you whether you're interested in sport running or more formal racing. If nothing else, you might get *your neighbors'* attention!

*The following are the addresses of the companies mentioned in this article:

Varicom Industries, 18480 Bandilier Circle,
Fountain Valley, CA 92728-8610.

Coverite, 420 Babylon Rd., Horsham, PA
19044.

Airtronics, 11 Autry, Irvine, CA 92718. ■

KYOSHO ASSAULT

(Continued from page 26)

mounted, so I reversed the upper mount screw so the shock was located on the aft side of "rear shock stay," rather than the forward side. This allows the shock to be more geometrically neutral than in the illustrated position.

The radio I chose for my Assault was the Astro 2-channel, 2-stick variety. It's available from Tower Hobbies* and I suggest ordering it at the same time as the car so you won't hold up "production."

The radio installation went exactly as described, with only the enlarging of the servo cutouts in the mount plate required. It's a good idea to pack as much sheet foam around the receiver and battery pack as possible. It helps absorb vibration and reduces the abuse your radio will take.

Installing the engine presented no real problems but after trying to mount it according to the diagram with no success, I decided to change the position of the "engine mount" plates. I positioned them so the angled end is forward/inboard, rather than rearward/inboard as shown in the illustration.

The Assault is supplied with an O.S.

.12 CZ-1 engine also from Great Planes Model Distributors, that's especially made for cars. For the benefit of you newcomers, O.S. is one of the leading manufacturers of model engines in the world, and I will go on record as saying I've never been unhappy with an O.S. engine. The new CZ-1 appears to continue that feeling.

The engine has two unique features that go a long way towards simplifying operation: a pre-adjusted carburetor mixture setting (no needle valve) that you'll likely never have to change, and a cone-type fitting at the rear of the engine for starting by airplane-type electric starter or pull cord. Of course, the "Zip" start system included in the kit works very well also—if you can't get this one started, maybe you should consider electric cars! I did discover a couple of important things about running the engine which I'll discuss later when we go "off-roading!"

You're in the home stretch now. All that's left is final linkage installation and some bits and pieces. Add the wheels and make sure the rears are tightened properly. Any looseness means lost traction. I wrapped a piece of tape around each half shaft to protect it, grabbed it with pliers, and really tightened the hub nuts.

You'll find three polycarbonate parts in your kit: the main body, the inner body with driver figure, and the wing. You can use almost any kind of paint on them, but the special type designed for polycarbonate or Lexan seems to work best. One advantage is that you can thin them with water—and there's no smell.

Before doing any painting, you'll need to trim the parts to the proper line with scissors. After that, wash all the parts in a warm detergent solution. Dry them off properly and start planning your paint job. Remember, paint these parts from the inside!

I masked off the clear window areas of the main body, scuffed the inside of all parts with fine steel wool to give the surface a "tooth" to hold the paint, and started painting. I used an airbrush (miniature spray gun) to paint my Assault. My color scheme starts out red, transitions to yellow, and finally to white. It's attractive and easy since it didn't require any masking other than the windows I mentioned. Okay, now add the stickers anyway you want, perform all the final checks, and get ready to boogie!

PERFORMANCE. The operating instructions included in the manual are excellent, so I won't review them here

The O.S. engine fired right up after about 5 or 6 pulls on the Zip starter. The muffler really quiets things down while still providing the sound only gas-powered engines can give. If the area you're running in isn't populated, I would leave the muffler off for the first six or so tankfuls of fuel. It let's the engine break in easier and it won't heat up as much. Do re-install it later, though, because the engine sounds better with it, not to mention the neat exhaust plume it captures.

I've really got to give credit to the Kyosho gang for incorporating the Zip starter on this car. It allows the racer to carry a minimum of equipment; all you really need are the zip strip, a supply of fuel, and a 1½-volt D cell ignition battery. Complementing this feature is the built-in ignition battery circuit, which eliminates the need for alligator clips and wiring for starting. You simply place the D cell in the spring-loaded holder on the front of the car, start the engine, remove the battery, and go race! It couldn't be easier.

I did find that the factory pre-set carburetor settings were too rich to allow the engine to produce enough rpm to move the car, let alone "assault" the terrain. I removed the small machine screw that holds the mixture disc adjustment and moved the disc clockwise almost one half turn. Unfortunately, the screw could no longer be installed since the disc covered up the tapped hole but I've been running the car this way with no detectable ill effects. It holds a proper mixture setting with no problem. I might eventually replace the screw but, at the moment, I'm having too much fun!

The steering is pretty quick and the throttle response keeps getting better as the engine breaks in. Once you get the hang of operating it, the Assault can be driven nearly anywhere, but the "off-road" environment is where it really excels—spewing gushers of dirt in a full-throttle, four-wheel drift; spinning out with a little too much throttle in too tight a turn; or leaping over obstacles that would make less powerful, less rugged machines head for the garage. The Assault seems capable of handling all of this quite well.

After each run, follow the lubrication recommendations in the instructions to ensure long life. I used a new material called Slip-It on all the linkages, bearings, and moving parts. It deposits a coating which is really slippery and doesn't attract or retain dirt like grease or oil does. It's available directly from Micro-Research*

for \$5.95. One bottle will probably last forever unless you discover new uses for it other than your R/C cars—which is very likely—because I have!

If you think there might be a gas car in your racing future, consider the Assault; it eats grasshoppers and frogs, and sure takes the sting out of hornets and scorpions!

**The following are the addresses of the companies mentioned in this article:*

Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.

Tower Hobbies, P.O. Box 778, Champaign, IL 61820.

Micro-Research, Inc., P.O. Box 2777, Danbury, CT 06813. ■

RC12i

(Continued from page 32)

faster cornering and more positive punch.

The rear axle is mounted in place with virgin nylon bearers bolted to the chassis and is supported in twin steel ball bearings. Rear-end action was smooth and easy.

The upper radio tray and dampener

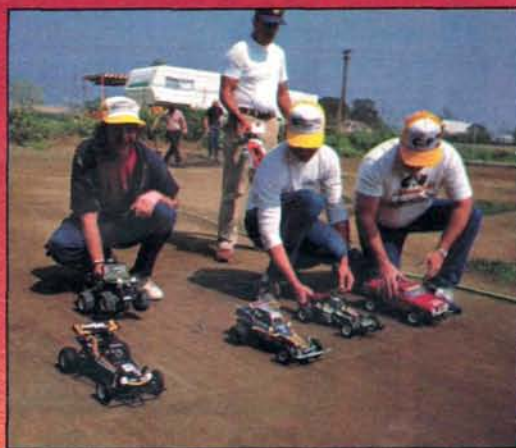
plate are mounted at the rear. The dampener plate has been updated since my last visit with a top-mounted tensioning spring. This tensioning spring maintains suspension at the rear and provides effective chassis flexing when needed. The radio tray is made of heavy fiberglass and is already cut out for installation of a small-size servo.

Motor and mounting assembly are next and here you see a bit of convenience at the motor mount. A toothed cam attached to the motor is used to make fine adjustments to the gear mesh while on the car. It's not really necessary, but it's awfully nice to have when setting up that car.

Once the motor is mounted, the electrical wiring can be completed. Use a soldering iron for this step. The instructions provided not only tell you how to wire, but they also include a diagram. By the way, the instructions are quite thorough and easy to read. Pictures are also provided and they leave no doubt as to how to assemble things properly.

The RC12i uses a ceramic resistor speed controller and wiper which rapidly dissipates heat at low throttle and provides very good linear power transfer. There's no reverse speed in the RC12i,

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What's New



THE ROAD WIZARD is a new 1/10-scale R/C car kit from MRC-Tamiya (2500 Woodbridge Ave., Edison, NJ 08817) that has a two-piece chassis with a 1.5 mm thick FRP frame for flexibility and light weight. The servos are mounted lengthwise and the nickel-cadmium battery and motor are located near the rear axle for the best balance. The speed control is a heavy-duty sliding wiper resistor with one speed reverse and back EMF-type braking for maximum controllability. The motor, the Mabuchi RS-540S, two polycarbonate body sets, and three decal sets are included. The Tamiya 5515 7.2 Volt Racing Pack battery is recommended for proper fit and for high-quality nickel-cadmium battery power.



WORLD ENGINES (8960 Rossash Ave., Cincinnati, OH 45236) introduces two new 7.2V car battery chargers. The first is an AC/DC charger with an electronic 0- to 20-minute timer for fast charging with an alarm. Flip the switch and it slow charges. It runs off either a 12V DC power source (cigarette lighter) or plugs into the wall. The second is a 12V DC charger. It has an adjustable 0- to 30-minute mechanical timer and automatic switch-over to slow charge. It runs off a 12V DC power source only.



THE GOLD PLUG SET from Aerotrend (31 Nichols St., Ansonia, CT 06401-1106) consists of a Tamiya-type male and female plug and gold connectors. Each connector is stripped, copper-plated, nickel-plated, and finally finished in gold. This process produces a superior connector giving you exceptional performance. The Gold Plug Set is also available with two male connectors only (stock #3903).



AEROTREND (31 Nichols St., Ansonia, CT 06401-1106) now has General Electric Rechargeable D Cell Battery Packs for those big cars, boats, and tanks. Five-cell (stock #3500) and six-cell (stock #3505) packs are available. With a minimum rating of 4,500 mAh, these packs are constructed with over 6 inches of Veriflex wire and gold connectors which are supplied. When constructed, they are connected with weld caps, not spot-welded strips, and they are triple heat shrunk for better protection.

Coming Events

(Continued from page 109)

Race site is at the Asnuntuck Community College, 170 Elm St., Rte. 220, Enfield, CT. Practice starts at 9:30 a.m., racing starts at noon sharp! All oval races: GT bodies only. Road race: Can Am. R.O.A.R. membership. For additional information, you can also call Wes Ford 203-749-7927 or Phil Olsson 203-668-1545

PANDEMONIUM RACEWAY (PR) Buffalo, TX and I-30 SPEEDWAY, Little Rock, AR (I-30)

June 7—(PR) 6 p.m. time trials, races follow.
 June 21—(I-30) 1 p.m. time trials, races follow.
 July 5—Second Annual 1/4-Scale Sprint Car National Championships (PR) 2 p.m. time trials, races follow.
 July 19—(I-30) 11 a.m. time trials, races follow.
 August 2—(PR) 6 p.m. time trials, races follow.
 August 16—(I-30) 1 p.m. time trials, races follow.

THE HOBBY DEPOT 81 Old York Rd., Bradley Gardens Bridgewater, NJ 08807

June 6, 8, 13, 20, 22, 29—Series races.
 June 15—Second Annual 500-Lap Oval Race.
 June 27—NASCAR Oval Race.
 July 6—5th Annual 50-lap Endurance Race.
 July 11, 13, 18, 20—Series races and rain dates.
 July 25—NASCAR Oval Race.
 July 27—Classic's Oval Race.
 August 1, 3, 8, 10, 15, 22, 24, 29, 31—Series races.
 August 17—NASCAR Oval Race.

RIVER CITY OFF-ROAD RACERS 10502 Nacogdoches Rd., NE San Antonio, TX 512-656-5724 (evenings)

Racing is every Saturday with registration closing at 3 p.m. Racing starts at 3:30 p.m.

SERCAR BoLink Raceway Park, Lawrenceville, GA 30245 404-963-0252

Races are every Friday night from April to October.

VALLEY RACING ASSOCIATION OFF-ROAD RACES St. Louis, MO John Shelby 314-382-7580

June 1, 15, 29, July 13, 27, August 10, 24
 Entry fee \$3 per car. Sign up 11 a.m., practice 10-11:30 a.m., racing at 12 p.m.

Radio Control Car Action welcomes news of coming events from clubs, organizations, and race tracks. To have news of your next event published free (space permitting), send your name, address, and telephone number along with the date, location, and time of the event, as well as a short description, to "Coming Events," Radio Control Car Action, 632 Danbury Rd., Wilton, CT 06897.

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RC12i

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but you won't need one for racing. Instead, the resistor's lower portion is used to supply dynamic braking to the motor and it's effective.

The RC12i is not a very large car, so it can only handle a small radio. My particular installation included miniature servos from two manufacturers, all of which are satisfactory. I chose an Airtronics* CSW-3 radio coupled to a 94461 servo for steering and an Ace* Bantam Midget servo for throttle. Airtronics' standard receiver fits like a glove up front.

Also supplied in the kit was a Kimbrough servo saver; a simple unit that is only a hair thicker than a standard servo arm, yet takes the place of larger, more expensive servo savers.

I used a Lola T-600 coupe body from Associated. It's made of tough polycarbonate plastic and is painted McLaren Orange. The body design is very aerodynamic and lends itself well to the use of a rear wing. I added my own wing. Only the antenna tube mars the beauty and lines of this Lola body.

PERFORMANCE: The RC12i comes equipped with a 6-cell battery pack and an Associated Stock 05 motor; legal for stock class R.O.A.R. racing. The RC12i is amazingly lighter than the RC12e, due to the use of lightweight fiberglass and work in a few places to eliminate excess weight. With the batteries warmed up and ready, I was ready to play.

One thing you find out quickly with the RC12i is not to punch her wide open the first time out. I did and she paid me back with lots of burned rubber and not a whole lot of forward progress. Later I rolled on the power (like you're supposed to) and was rewarded with a controllable rocket!

Handling out of the box was very good without any tire preparation. The RC12i maintains a solid line down the track without any wandering or nose fighting. Differential action seemed quite effective when cornered and was obviously working well when I punched her out of the corner.

The suspension as set up from the box worked very well, smoothing out the asphalt and keeping the tires down where it counts—in contact with *terra firma*. Some roll was apparent with the mono-shock front end, but it never reached a point where traction was lost. It felt very solid and controllable at all times.

Unfortunately, 9 minutes worth of fun seems like only 1 when everything is working right. It's at times like this that having a few more battery packs is what you really need. The RC12i gives you a feel for fast times and it will definitely have you track racing if that's what you desire. This car has the handling, sophistication, and exotic flair about it that just itches to get out on the track.

If this is what you dream about, then dream no longer. One of the best R/C cars just got better. Drive the RC12i just once and find out!

**The following are the addresses of the companies and organizations mentioned in this article:*

Associated Electrics, 1928 E. Edinger, Santa Ana, CA 92705.

Satellite City, P.O. Box 836, Simi, CA 93062.

Airtronics, 11 Autry, Irvine, CA 92718.

Ace R/C, 116 W. 19th St., P.O. Box 511C, Higginsville, MO 64037. ■

RPS YOKOMO SE

(Continued from page 69)

turns, I headed for home with a very impressive run.

After the initial run, I pitted for some suspension tuning and a fresh battery. As the afternoon wore on, this machine just kept on outshining every race car around. I can't impress upon you enough how sure-footed and power-responsive the SE is.

When I arrived back at the shop, I cleaned the car. Because of the open access of all components after the body is removed, it was a quick and easy job. I checked the drive chain for stretch and found none, and the suspension corner points for damage and again everything was fine. The only thing you might want to consider is securing the steering servo with not only servo tape but possibly hold-down posts to ensure as little movement as possible of the servo due to torque. My experience showed that steering did wander a little after the track test, but not enough to warrant panic.

The RPS Yokomo SE is, without question, the force that racing will have to contend with for some time to come. I truly believe that the inspired changes in the RPS Yokomo SE have bred a remarkable performer; a performer that will have the competition taking a closer look—or a look from afar as the case may be.

**The following is the address of the company mentioned in this article:*

RPS Distributing, 1655 E. Mission Blvd., Pomona, CA 91766. ■